73 magazine
for radio amateurs

$1.00
January 1973
26009

ham radio's last year?

see page 24

73 magazine
for radio amateurs

#148 JANUARY 1973

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73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year in North America and U.S. Zip Code areas overseas. $7 per year elsewhere. Two years $11 and $12 overseas. Three years, $15, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A.

Phone: 603-924-3873.

NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

REPEATER GROUP ACTIVITIES

One of the great benefits of repeaters is being passed up – more's the pity. Every member of a repeater group has one thing in common – the ability to communicate through the repeater. For some strange reason this unique ability is not being taken advantage of.

There are several valuable functions that can be carried out via the repeater – functions which might help to build the club in members – in prestige – and in service. Obviously the repeater can be used to carry announcements of interest to the group – meeting announcements – repeats of ARRL bulletins – FCC releases – propagation news – and even DX news, if there is some value in this to some ops – news of nearby repeater group meetings and functions – hamfest and convention news for the near and far future – plans for outings such as Field Day, VHF Contests, stuff like that – and plenty etc. If every member of the club was vying to bring news to the repeater, it could be interesting and valuable.

Suppose the news time is set at a convenient time every night, perhaps 8 PM. The club trustee can officiate and solicit news items from members. It could be a lot of fun and help to bring the club together – plus increase interest in club functions.

The next step is to set up weekly technical symposiums – with one member on tap to give a talk and then answer questions from all the listeners. This can be taken from the License Study Guide series in 73 and will help members prepare for their higher licenses.

How about code practice? Why not? A fifteen minute code practice session every night would soon have every club member ready for that General license. You could even go on to Extra, if there is interest. You can use code records, tapes or a member with a key – if there is one. How about starting those code sessions at 7:45 and then give a five minute break at 8 for identifying – then on to the bulletins and stuff?

There is little doubt that you can build up quite a listening audience to such goings on. You will find that not only are all of your members making a big effort to tune in, whether they are at home or in the car, but you'll also start getting listeners with scanner receivers.

GETTING RICH

The more I think of it, the more I'm convinced that one of the really great opportunities open to radio amateurs is in the selling and installation of security devices.

Our radio and electronic background gives us what we need in the way of skills for designing and installing systems.

It is a business that can be started in your spare time and requires no big investment in equipment or offices. You can get started with little more than some letterhead and a phone number.

The market is virtually unlimited – every home, office, business, warehouse, etc., is a prospective customer. You can get started with small home installation and work your way up to large plants and even entire towns.

Your sources of equipment are simple to locate – several distributors have excellent catalogs out. You can sell the system – take a deposit for the job – order the equipment with the deposit – and then make your profit when the job is done and working. And then there are the residuals – the service contract which brings in money from then on.

If you have any question about the validity of the idea, just ask your wife whether she would like to have an alarm system or not. When you are away she will feel a whole lot safer if there is an alarm. You are fortunate if you haven't been burglarized as yet – and the chances are that you have at least one neighbor who has come home to a big surprise – like no more television set – no hi-fi – no cameras – the works.

Once you get started in your spare time the business will take over and you'll soon be working full time – and then some. Then comes employees – salesmen – bookkeeper – and branch offices.

If you do get into this business you would do a lot of fellow amateurs a big favor if you would write to 73 and tell us how you are doing. If you manage to discover some pitfalls you could pass along the word so we could be sure that no one else misses them. Do write.

AM DEAD YET?

The FCC warning about using AM on the 20-40-80 meter bands was strongly put in Docket 19162 which is effective November 22nd. Paragraph 7 states that ". . . we strongly urge that . . . full power double sideband (AM) emission not be used in the lower four HF bands except in an emergency . . . " The message is clear.

Wondering how this edict would be received by some of the AMers on 20m, I tuned up the band the other evening and heard W6QS in contact with a WØ and he was bragging that he was one of a substantial group of AMers, mostly running kilowatts, who were holding forth on the band. When he finished his contact I broke in to ask what effect the new regulations requesting that AM not be used were going to have. I got my answer short and sweet when he called me a liar three times and then switched his rig off.

While I was disappointed to hear this CB-type operation from an old timer with a two letter call, I can't say that I was honestly surprised, for I realize that the emotional reaction to being asked to quit AM is just as strong as was the reaction when the FCC said no more spark in the 20's.

How much nicer for all of us are the chaps who embrace new ideas and new modes – the fellows who get into slow scan – satellite relaying – like that. We will always have a few curmudgeons who will fight progress to the last ditch, rationalizing as they go down. The FCC is, for once, stating the majority opinion when they say that we really can't afford the luxury of AM on the lower bands.

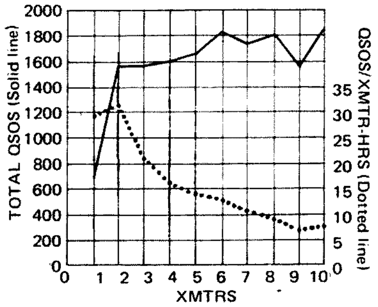
FIELD DAY PLANNING

The Foothill Amateur Radio Society (Mt. View, Cal.) brought up a very interesting point for Field Day committees to ponder when they are making their plans for 1973.

Ted Harris W8RPA/6 did some research on the average number of contacts scored by the five top clubs in each transmitter group over the last five years and put the info on a chart. The result is fascinating and seems to defy logic. At the very least there seems to be a lot to learn from it.

Plotted on the chart you can see that the number of contacts made per transmitter drops off after two trans-

mitters. Three transmitters did not result in any more contacts than two! And four didn't help matters very much either. Nor did the fifth. The sixth transmitter seemed to make more of a difference – perhaps that one should have been used in third place. The seventh transmitter must have broken down so often that number six had to take time off to help fix it. And how about the nine transmitter clubs doing worse than the two transmitter efforts! How is it possible to make fewer contacts with nine rigs than two? Perhaps they were all on the same band.



It would appear that a whole lot of planning is needed to change this weird pattern. There must be some way to make more contacts with three stations than two!

Continued on page 142.....

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Last year during the worldwide Slow Scan contest there was an apparent trend toward white lettering on a black background. If I were to make an educated guess on this year's trend, I would probably say 4 second i.d. frames will be quite popular.

A 4 second frame displays your call, for example, on the top half of the screen, then as the trace nears the middle of the screen, a 1200 Hz vertical "blip" comes along and resets it to the top, and the procedure is repeated. Since your call is now being presented twice as often on the top half of the screen, while the bottom half is not being swept, the result is a brighter image, and if QRM "zaps" part of your call on the first sweep, chances are the second sweep will fill in the gaps, thus still making your call perceptible. How do you obtain 4 second frames from your gear? Well, the vertical rate control may adjust down to a 4 second rate, or IC "counters" can be tapped at this point. If you don't care to go into your commercial gear, just make up some 4 second tape loops (I described tape loops in the September '72 column).

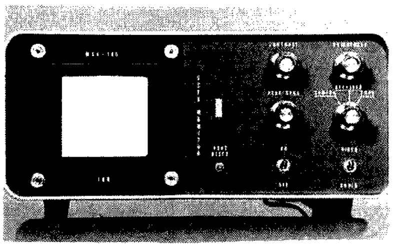
First SSTV QSO via Oscar 6. Not bad!

Don Miller W9NTP and Phil Howlett WA9UHV have laid claim to the first SSTV QSO via an amateur radio satellite. During orbits 30 and 41 they successfully exchanged reasonably fair pictures through the then 4-day-old Oscar 6. Although they had managed to exchange approximately 40 partial frames during earlier orbits, it was not until October 19 that pictures approached "solid copy" state. This month's "Oscar 6" picture (compliments of W9NTP) was one of the first few received by Don from WA9UHV. Not bad, eh? Probably you noticed the two or three Slow Scan signals through the satellite during each pass varying tremendously in level. This was due to the CW signals "loading down" the little "one watt repeater." Here in Alabama, the only distinguishable pictures (during that first week of Oscar 6) were from WA9UHV, as he and W9NTP tried for a perfect exchange. Now, since the satellite has been up a while, activity has probably settled down to where Slow Scan is easier through the satellite . . . look in some night between 29.450 kHz and 29.550 kHz (W1AW nightly bulletins give times of equatorial crossings). I think you will agree, Slow Scanners have the persistence of a P7 tube, and the enthusiasm of a firecracker.

The independent sideband system (transmitting audio on either upper or lower sideband, and video on the other (simultaneously) is growing in interest, and may become quite popular during '73. W7FEN, the "Father of the ISB idea," and WØLMD/4, have developed ISB units for use with commercial gear, like the Heath Transceivers. I understand WØLMD's unit uses a pair of surplus Collins filters, and has exceptional SB to SB and carrier suppression. If you're seriously interested in this system you might contact either Gervie W7FEN or Robert WØLMD for circuits and specs.

If you haven't already heard, another company, Thomas Electronics, Box 572, Hendersonville TN 37075, has recently entered the Slow Scan field. The info on their gear looks great. Their monitor displays a 4.5 in. picture, has an attractive aluminum CRT bezel, sync tuning meter, and vertical retrigger button mounted on the front panel. I think their camera is a real winner. Slow and Fast Scan outputs are provided on rear panel jacks. In fact, you have a choice of video or rf Fast Scan output; thus you can use your regular TV set as a Fast Scan monitor (even while televising Slow Scan!). Further, the Fast Scan output is adjustable from Channel 2 through 6, so you can pick a blank channel for your area. Another big advantage of this camera is the built in ac power supply; thus the camera is completely self contained (you SSTVers with only a monitor and tape recorder take note here). I suspect we will hear quite a bit more out of this company during 1973.

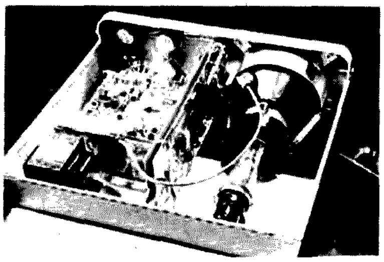
THE MXV-100 MONITOR



One of the newer companies to enter the SSTV field is J & R Electronics of Poughkeepsie, New York, who is manufacturing the MXV-100, a superb slow scan monitor.

The monitor is built in a Heathkit styled cabinet the same size and color of the SB-200. The front panel is dark green plexiglass with lettering behind the plexiglass, resulting in quite an attractive unit that matches Heath equipment perfectly.

Inside, viewed from the front, the cathode ray tube is mounted on the left and the two plug-in printed circuit cards are mounted on the right. The smaller card is the high voltage power supply and the larger card contains the major monitor circuitry. A third printed circuit board is mounted vertically in approximately the cabinet's middle. This contains the interconnections for the other two boards, and some of the low voltage power supply components. The remaining low voltage power supply components are mounted under the chassis. A 6FG6 tuning eye tube is mounted on the front panel for aid in tuning signals



Inside view of the MXV-100 monitor.

properly. Except for the 6FG6 and cathode ray tube, the monitor is all solid state.

During actual operation, an incoming slow scan signal is fed to the main monitor circuit board, and is then limited and amplified. The 1500 to 2300 Hz tones are then passed through the low pass filter to the video amplifier. Output of the video amplifier (approximately 100V) is sufficient to totally cut the beam off on absolute blacks, even when the brightness is extremely high. The sync pulses are taken directly from the limiter, and processed through two filters, the noise immunity circuits, and the pulse shapers, before reaching the sweep circuits. The result is a monitor that really "digs in" to get those slow scan pictures. We particularly liked the sync circuitry of the MXV-100. Briefly, it works like this: A 30ms 1200 Hz pulse is received and a picture starts. The input gate then closes and doesn't open again until time for the next pulse; approximately 7½ seconds for the vertical, and 50ms (length of each line) for the horizontal. If a pulse is received, the trace is reset and the process is repeated. If no pulse is received, the dot stays deflected off the screen. This type of gated input makes false triggering of either the vertical or horizontal practically impossible. A manual vertical retrace button is mounted on the front panel in case a retrace pulse is lost.

The noise immunity circuits in the MXV-100 compare the input pulses against a predetermined level. If they are of the proper amplitude, they are accepted as sync pulses. If they are too low, they are rejected as noise. The circuit will follow a signal right down to the "trash" level before rejecting it. Remember, the active filters have already ascertained the pulses are 1200 Hz pulses.

The unit we received for evaluation did a beautiful job. During some tests, using taped pictures with known content, other local slow scanners and myself noticed small details we previously had not noticed significantly with our own monitors. The pictures appeared exceptionally clear and quite bright. I think this is mainly due to the aluminized 5AHP7, an electromagnetically deflected and electrostatically focused cathode ray tube, with 5500V on the accelerator. Also, there is no yellow filter on the face. Although one can easily be added, we personally prefer the unfiltered screen. I found a viewing hood unnecessary. In fact, I didn't even cover the window during afternoon operation, when the sun reflects into the shack (this usually requires a hood with my 5UP7 homebrew monitor).

The low pass and noise immunity circuits did a superb job pulling signals right out of the mud. Often I could read a station's call sign off the screen before I could hear them give their call. If QRM came on close to 1200 Hz (and it had to be close – the filter is pretty sharp) for, say, one second, the monitor would merely leave a blank space of 15 lines (120 lines divided by 8 seconds = 15 lines per second), then immediately lock back and resume the picture. In fact, the ability of the monitor to "latch onto" a signal instantly was quite attractive.

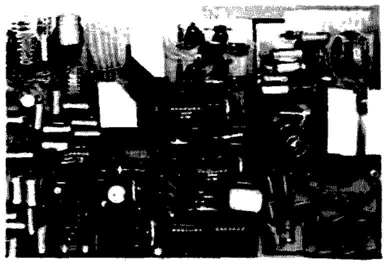
Although the 5 inch screen may seem slightly small to some of you (there is a trend toward the 7-inch screens), this was fine for me. Possibly this is because I located the MXV-100 right above my present 5 inch monitor, which was placed for perfect eye to screen distance previously.

The sync tuning eye is a unique feature of the MXV-100. Since the sync frequency filters are sharply tuned, when a signal is off frequency, the screen is dark, instead of streaked to one side or the other and the eye tube (like on some stereo tuners) is "open." As the signal is tuned on frequency, the eye closes (again, like a stereo). This foolproof tuning has to be seen to be appreciated.

The unit uses top quality parts throughout, and boards are G10 class. All inline integrated circuits are plugged into sockets for easy servicing.

I noticed the deflection yoke was a Stancor item, with a long part number, evidently specially made for J & R.

All connections to and from the monitor are on the rear of the unit, and connection to your rig is described fully in the operating manual.



Close-up of the neatly engineered circuit boards.

All in all, we found the MXV-100 a real gem of a monitor.

I understand J & R is working on a slow scan camera system, which may be offered soon in an attractively priced monitor/camera package.

Once again, the manufacturer is *J & R Electronics, Box 1646, Poughkeepsie NY 12601.*

. . .K4TWJ

ENGLISH RADIO MUSEUM

Are you interested in seeing what wireless was really like in the twenties, and hearing those crystal-sets and horn speakers swarking away . . . well, just pop over to England where they've opened a Wireless Museum, the only one in the world where the visitors are permitted to handle the exhibits! There are dozens of sets on view, many of them dating from the early days of broadcasting in England – 2LO opened up in November 1922. There is even one which was used in the trenches during World War I. The Museum is run by the recently formed Wireless Preservation Society, devoted exclusively to the collection and renovation of wireless and electronic equipment for purely cultural, educational and historical purposes. It is an entirely non-profit making organization, and all its officers are honarary. The hon/secretary and Musuem Curator is Douglas Byrne, G3KPO, of Homa House, Quadring Watergate, Spalding, Lincolnshire, and it would be advisable to contact him by ringing STD 077-584-485 prior to a visit to the museum.

RRTY GEAR

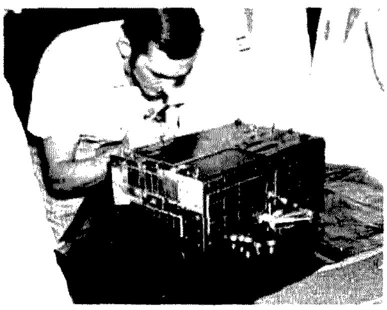
The Santa Fe Railroad has recently been replacing its in-service Model 14 & 15 Teletype gear with more up-to-date units. It seems they had no idea that someone might still be interested in such "out of date" equipment, so they sold most of what they had in ton-lots as SCRAP METAL! Bill Johnston WB5CBC heard about this sacrilegious action and managed to have a hold put on the 120 or so units left. The gear is being sold as-is, but most were pulled right out of service and are in perfect shape. The units are along the Santa Fe's main line be-

tween Topeka, Kansas and Los Angeles CA, and must be picked up at their location. Prices range from $10 for a Model 14 Non-Typing Reperferator to $25 for a Model 15 Page Printer. Contact Mr. C. C. Glover, Purchasing and Materials Dept., AT&SF RRY, P.O. Box 1674, Topeka KS 66601.

AMSAT NEWS

Mike Frye WB8LBP
640 Dauville Dr.
Dayton OH 45429

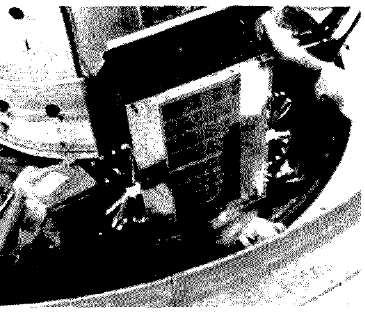
THE OSCAR 6 AMATEUR SATELLITE IS IN ORBIT!



NASA team inspector swabbing down AOC (courtesy NASA-USAF).

OSCAR 6 was launched from NASA Western Test Range on Sunday, October 15, 1972, piggyback with the NOAA-2 weather satellite. Its big Thor-Delta rocket put it into orbit over the South Pole. It flew across the Equator east of Africa, and the spacecraft was ejected over the Mediterranean. OSCAR came to life immediately, and European and African amateurs reported hearing signals through the satellite repeater.

OSCAR is in a circular polar orbit 910 miles high. Thus it is line-of-sight to stations nearly 2,500 miles away. Amateurs 5,000 miles apart should be able to communicate through it. OSCAR circles the earth every 115.0 minutes at an inclination of 101.77 degrees. In that time the earth has turned to the east under it 28.75 degrees in longitude. Therefore, if you have one official prediction, then by simple addition you can figure out all future equator crossing times and the corresponding longitudes. Copy the broadcasts from W1AW any night get



Satellite as it is being placed inside ITOS-D rocket (courtesy NASA-USAF).

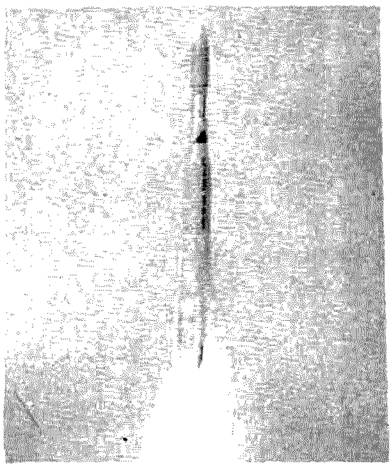
orbital predictions for the next day. The speed of the satellite is in excess of 15,000 mph. Hence the Doppler shift will make the signals slowly drop in frequency on your receiver as much as ±4½ kHz each passage. The power output on ten meters is about a watt maximum to a dipole.

OSCAR's repeater is entered on two meters – 145.90 to 146.00 MHz. Signals are relayed out on ten meters – 29.45 to 29.55 MHz. You should hear signals throughout this 100 kHz passband, and up to 50 kHz below and above it. All modes can be used through it, but CW and SSB are the most efficient. Technicans are authorized to operate through the satellite by FCC waiver. The satellite is sun-synchronous, i.e., it will appear overhead at approximately the same times each day, around 9 AM and 11 AM each morning, and 9 PM and 11 PM each night, regardless of your location. The morning passes come down from over the North Pole, and the night passes come up from across the Equator. A flyover lasts only about 20 minutes, so you must know the times pretty closely. If you have a ten meter beam, lucky for you. Most of us are using just dipoles or long wires. Just 10 watts of two meter

Satellite and launch vehicle on the pad just before countdown started (courtesy NASA-USAF).

power is adequate to work through the satellite, particularly on an overhead pass.

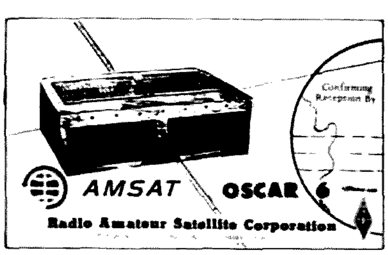
K2RTH of New York was able to hear his own signals through the satellite when it was over Dakar in W. Africa, over 3,000 miles away. Amateurs in over two dozen countries are being heard and worked through OSCAR. OSCAR also carries a beacon on 435.10 MHz. It has 300 mw output and sends 24 three-digit numbers representing telemetry in Morse code at 10 or 20 wpm. This tells us the operating conditions within the satellite.



OSCAR 6 launch, Oct. 15, 1972 at 1719 GMT (courtesy NASA-USAF).

OSCAR 6 has solar cells and a nickel-cadmium battery and was built for a year or more of useful life. So there is plenty of time for you to get equipped on 145 and 435 MHz.

Keep a log of stations heard and worked, with date and time. Submit your log periodically to AMSAT and you will receive a colorful QSL in return.

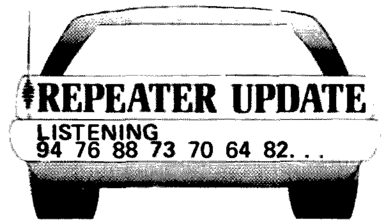


OSCAR 6 QSL card. To receive one, please send report to AMSAT, Telemetry Dept., P.O. Box 27, Washington, D.C. 20044.

For more information or problems you may be having, please send SASE to me and I will do my best to help you.

I would like to thank Palmer E. A. Back WB6OLY for helping me get the photographs.

WB8LBP



AR	WB6KFK	Forest City	16–76
CA	WA6TDD	L.A. FM 147.435–146.40 AM 147.405–145.40	
CT	W1WHZ	Norwalk	147.99–39
MA	W1OC	Billerica	147.72–12
PA	WA3KFX	Hollis	01–61
PA	WA3KXI	Lancaster	34–94
PA	WA3CAG	Trevose	19–79
RI	K1OHE	Delete	

RTTY REPEATER

A new FM repeater serving the Bay Area RTTY stations has just been announced, according to Tom Nelson W6QGN. Using 2125 mark/2975 space tones at 60 wpm, it has an input of 147.93 MHz and an output of 147.33 MHz.

The new repeater is a joint effort of WA6EUZ and WB6IMP and will temporarily operate under the latter's call. It will be an open repeater and all amateurs are invited to participate. Although presently installed as a COR (carrier) access direct audio device, future modifications will provide signal regeneration, automatic date/time entries, and other special features.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

A previous column made mention of WTWO-TV with reference to this station being located in Indianapolis. W9JCU, who happens to be the Chief Engineer, sets me straight on the actual location, which is Terre Haute, Indiana. This is what happens when you don't make a log entry and rely on your memory for the details. Arden goes on to say that the GE Bat-Wing antenna on a 1000' tower, was loaded up on 6 during Field Day, and between the hours of 1:3 0 and 6:00 in the morning, 22 States were worked. How would you like to have an antenna like that on a permanent basis?

WA1EXN reports conditions had been very poor until the opening of October 17th. Art says, "This is the first time in 7 years of VHF operations that signals ever pinned the S meter at slightly over 60/9. Ask WØHZ." Art worked WØ's, W4's, and W9's during this one. A brief opening from Maine to Florida was noted on October 30th from 1436 to 1638Z. October 31st and November 1st brought very good aurora. I also worked these openings with very good results. Among those most active were K9HMB, K8BBN, WA8MLV (running a Yaesu transverter), WA1OUV, VE3FHK and WB3JCK. The most unusual contact reported was from the Chicago area to Casper, Wyoming.

VE1ASJ is off the air on 6 at the moment due to a storm blowing a tree against his tower. A new tower is in the works and may well be in operation by the time this appears in print.

WØTVD, Omaha, would be happy to sked anyone needing Nebraska. He runs a Swan 250C and a 6 element wide-space Telrex at 55 feet. Chuck says in his letter that WØCCD, known as "Grandma Lou", will be back on the air with a Swan and a 6 element Hygain thanks to her many friends around the country. I can personally verify that she made the grade. Just a few evenings ago I heard her talking to John WAØHTP. Chuck mentions the October 17th opening as having lasted around 5 hours, working its way down the east coast, across the Gulf states and finally ending up in the Texas/ New Mexico area.

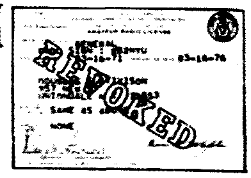
Bob WB8JHT, will soon has a new KW PEP linear on the air – in fact, it should be in operation by now. Bob will be running a pair of 4x150A/7034's in a passive grid configuration similar to the one in the July 1969 issue of 73.

Anyone interested in running a beacon will find any number of endless loop tape recorders on the surplus market currently. These are usually described as "message centers" or something similar. Prices run from $4 to $12 depending on how deluxe a model you buy. The cheapest I have seen is from Burstein-Applebee, Kansas City, as $3.95. A few simple modifications are needed to make it acceptable for this purpose. I will be happy to send a list of hints to anyone interested.

WAØABI

Keith Lamonica W7DXX/1, Managing Editor of 73, listening to the first "beeps" of Sputnik I a few years back (too many).

WITH THE FCC



OUCH!
See the proposal on page **24**!

RM-1604
Before the
Federal Communications Commission
In the Matter of

Amendment of Part 97 of the Amateur Radio Service Rules to revise the station identification requirements for transmissions of less than two minutes. Order adopted October 20, 1972. Released October 20, 1972.
By the Chief, Safety and Special Radio Services Bureau.

1. The Commission has under consideration a petition filed by Michael R. Beverly proposing amendment of Part 97 to change the station identification requirements for amateur radio communications of two minutes or less.

2. The petitioner proposes to add a new subsection to § 97.87 which would require the control operator of an amateur station to identify his station and the station being called at the beginning of a transmission and, if the transmission was less than two minutes in length, the concluding identification would consist of only the calling station's call sign. The Commission's Rules on station identification require the control operator to identify both his station and the station he is calling at the beginning and conclusion of every transmission.

3. The petitioner asserts that this proposed change will facilitate punctuality and efficiency for short exchanges. Petitioner further asserts that compliance with our present identification rules is difficult with a very short transmission.

4. The present station identification rule provides rapid identification of a station to prevent one way communications broadcasting, identification of stations conducting international third party communications, and identification of stations conducting radio communications with stations in countries which ban communications with U.S. amateur stations. While the required form of identification may be somewhat awkward during very short transmission, the reasons for this identification procedure remains the same regardless of the length of the communication.

5. The Commission, therefore, believes that there is no justification for this proposed rule amendment. In

view of the foregoing, the rule making petition plainly does not warrant Commission *en banc* consideration. Accordingly, the Comission by the Chief, Satety and Special Radio Services Bureau, pursuant to the authority delegated in §0.332(m) of the Commission's Rules, ORDERS, that the petition filed by Michael R. Beverly is DENIED.

Federal Communications Commission
James E. Barr
Chief, Safety and Special
Radio Services Bureau

990 kHz SPACING

The proponents of discarding the adopted 600 kHz band plans (CARC, SERA, NERA, Texas, Central States, etc.) have listed a number of potential advantages of going to a wider input/output spacing on two meters. It is instructive to examine the technical facts of the matter.

The most frequently stated advantage of the wider split is a reduction in repeater receiver desensitization. Let us examine the actual numbers. Most FM receivers and transmitters have a selectivity characteristic which is dominated by two poles for strong off-channel signals greater than 200 kHz (at two meters) removed from the desired frequency. The slope of such a selectivity characteristic is 12 dB per octave. Therefore the reduction in desensitization achieved by going from 600 kHz to 990 kHz separation is given by

$$40 \log_{10} (990/600) = 8.7 \text{ dB}.$$

Since a typical duplexer has 90 dB of isolation, this improvement of less than 10% is hardly worth the effort and expense of a major recrystalling job. In addition, the power limitations imposed in Docket 18803 will make the wider split less attractive to those high power repeaters who used the additional few dB of isolation to compensate for marginal duplexer performance. (W1GAN has shown that his duplexer design has isolation which is adequate for at least 60 watts of RF, which is 240 watts ERP when a 6 dB gain antenna is used. In fact, his duplexer is being successfully used with up to 200 watts of RF.) Even if the full 8.7 dB could be realized as improved receiver sensitivity, the increase in repeater range would be something less than a factor or two. Since a typical duplexer cavity has 30 to 35 dB of isolation, we will not be able to use fewer cavities in a duplexer for 990 kHz spacing.

It has been proposed that to ease the repeater user's burden, each existing repeater should establish a second 990 kHz repeater using the old output frequency for the input of the second repeater. Thus no one would be stuck with useless crystals. The fallacy here is that the new repeater's output and the old repeater's input are still separated by 600 kHz, and similarly for the old output and new input. Therefore, there is actually no gain in transmitter/receiver isolation if these two repeaters share one site.

It has been claimed that the shift to 990 kHz spacing will give us more repeater channels. Of course, this advantage is negated by the proposal that every repeater group use two frequency pairs. At first sight, it would seem that 990 kHz spacing would yield 33 repeater channel pairs compared with 27 (an increase of 22%). However, a guard band is required between the repeater input and output bands to reduce intermodulation interference to repeater inputs. There also is a demand for simplex channels on which no repeater operates. Thus the apparent gain in total number of repeater channels will not be realized in practice.

The most common argument against the existing 600 kHz band plan (half of the channels in-low/out-high and half in-high/out-low) is that transmitters cannot operate efficiently over a 2 MHz spread in frequency. However, such arguments have no basis in fact. We have experimentally verified that the power output of the Motorola "80D" transmitter is down only 1 dB ±1 MHz from the frequency for which it is tuned up. This small reduction in output power will cause no perceptible reduction in communication range. Therefore, if a transmitter is peaked at 146.94 MHz, it should conveniently cover the entire FM repeater segment of 146–148 MHz.

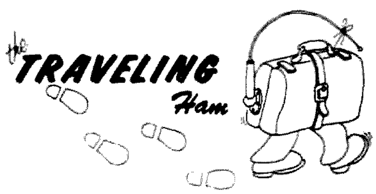
In general, receivers will not cover such a large frequency spread without a greater loss in performance, due to having a larger number of high-Q tuned circuits in their input stages, so that it makes good sense to keep all the output frequencies clustered together.

It has been claimed that it is impossible to use a "sensitive solid state receiver" in a one-site repeater with 600 kHz spacing. The experience of some of our more progressive repeater groups directly contradicts this. In fact, a properly designed solid-state receiver will be less susceptible to interference than will a more conventional receiver using vacuum tubes. Modern solid state devices offer performance that could only be dreamed of a few years ago.

Some amateurs feel that frequency synthesizer design will be more complex with the current 600 kHz band plan. However, those of us who have actually designed and built synthesizers know that no one offset is any harder than any other, provided it is an integer multiple of the channel spacing. From the user's point of view, it is easier to use an offset that is a multiple of 100 kHz, since the mental arithmetic is easier.

Finally, we should go back a few short years in FM history and recall that our FM pioneers were satisfied in many cases with a 420 kHz split. Perhaps 90% of the repeaters in the U.S. are on the 600 kHz standard today. Let's keep it that way.

L. D. Collins K4GGI
S. J. Murray K1KEL
P. Catala F2BO/W1



Joe Kasser G3ZCZ/W3
1701 East West Highway, Apt. 205
Silver Spring MD 20910.

Establishing communications with the locals when on a trip can be as difficult as you make it. If you can work into the area on the hf bands beforehand, you'll usually get a name and telephone number to call when you arrive. If you have a Technician call or do npt have any hf equipment, then get a friend to call someone on the band for you.

When you go take an up-to-date callbook with you. Take some gifts with you, too. If you are going overseas don't forget to take advantage of the duty-free liquor and cigarettes available. They make very useful presents. U.S. postage stamps and magazines or knickknacks are appreciated by those who collect the things. To another ham who homebrews, some of the more exotic (and expensive overseas) IC's or VHF power transistors will be appreciated almost as much as gold ingots. If you did establish contact prior to your trip, you could always have asked what to bring. Twenty-one cent mint postage stamps will be appreciated by the DX'er who has to purchase IRC's to get QSL cards from stateside managers.

If you take a rig with you and get a permit, call in on a local frequency or repeater. Your foreign call or reciprocal one and unusual accent will be recognized, and you will have a small pileup on your hands if you are on VHF. If you ask for information

about clubs, stores and activities one or two telephone numbers are bound to be mentioned.

If you don't take a rig, use the callbook blind, by looking up calls in the local area, then looking up the name and address in the phone book. This is not an instant success method because the chap may not speak English, or may not be at home or active, or may just be unfriendly.

If you are able to monitor the local bands, then you can look up those calls that you hear in the call book and cross reference to the phone book. If you don't speak the local language fluently, then try to get someone else who can, to make the call – or if that is not possible, then practice the important sentences over and over again before making the call – ones like: "May I speak to . . . . '', or, ''I am . . . . . . from . . . . .What ham activity is there in the area?

Explain who you are, say that you are monitoring him but don't ever ask for an invitation to his home. Ask instead about local stores, clubs and activities in general. There is a 99% probability that he will invite you to his home, so why push yourself on him. Let him be the good guy.

I'd like to use this column to pass on trips from travellers to intending *ones*, so please let *me hear* from you.

For those going to London, England, the two meter repeater reported to be there is actually in Cambridge. More about that next time.

G3ZCZ

INDXA NEWS

INDXA NEWS LETTER
From THE DXERS MAGAZINE

During the past 2½ years Indxa has been associated with a few DXpeditions. I define a DXpedition as one or more hams going to a specific place at a specific time for the sole purpose of making as many QSOs as possible in a time span of 2 days to maybe two weeks. Below are shown the result of a few of the operations.

Place	Duration	No. Ops	No. QSOs	Remarks
Palmyra	1 week	1	1600	Transceive-murder
E. Pakistan	4 days	1	800	Transceive-dipole
Dominica	4 days	1	3600	Split-beam, ssb/cw
Norfolk	2 weeks	1	10,000	Split-beam ssb/cw
Willis Is.	6 days	5	10,500	Multi-split-beam
Bajo Nuevo	3 days	4	4200	Split-hurricane
San Felix	3½ days	2	7000	Split-beam

From the above data you can see that the results are about what you would expect, but the weight to be attached to each factor is not so evident, i.e., is it better to have more operators, or one operator with a beam (considered to be synonymous with a stronger signal). In my experience with planning and working DXpeditions (I have never been on one) the following factors emerge:

1. By far the most important factor is to have a good signal into whatever area of the world is being worked. This outweighs all other factors for the simple reason that if the callers can't hear the DX they don't know when to call and when to shut up. If you have ever heard OD5BZ working transceive and making 200 QSOs per hour you know what I mean. He was 40 over everywhere. DXpeditions should use beams no matter what else ain't.

2. The skill of the operator(s) is next. Courteous but firm, produces the best results. Outright nastiness produces more of the same and trying to accommodate everyone at the same *time produces* chaos.

3. Split frequency falls third in importance in my opinion. It helps a great deal of course, especially in the first hours of operation when the DXpeditioners are trying to get rid of the first two thousand big signal Ws and about 500 DX headhunters. After that its importance goes way down.

4. There is a strong tendency to forget most of the big guns have mixed totals, i.e., both phone and CW. A good CW operator can still run rings around a phone operator. In other words, the number of satisfied customers goes way up when a good CW operator is on the DXpedition.

5. After the above items, lots of things enter into the total QSOs. The time spent operating is obviously germane. About 12 kilo QSOs will wipe out any place. That means 2 operators operating 4 hours on and 4 off for 6 days, alternating phone and CW.

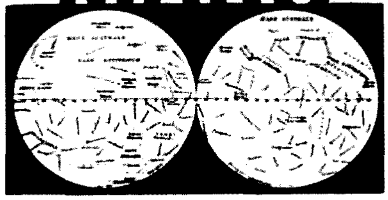
6. The bands operated should be considered. Twenty is still the work horse, followed closely by fifteen. Ten meters is great for a few hours a day. The low bands should be used only to accommodate the 200 or so guys working for 5BDXCC. Really there are surprisingly few of them. I have never seen any DXpedition for which I QSL work more than 120 stations on 80 and 40 and most of those did not request a QSL. The number of topbanders you can count on both hands and no toes.

In summary, one or two guys going to a rare one, operating transceive with a vertical, produces frayed nerves, frustrations, and a barrel of fun. Us big gun, big signal, persevering, skillful operators get through anyhow. Heh, heh, heh. You peasants wait for the multi-op, split to linear to beam operation and you might make it.

Not that it has anything to do with conducting DXpeditions, but you might be interested in knowing about QSLs resulting therefrom. 8000 QSO's will produce about 1500 requested the first week, another 1500 in the next two months, another 1500 in the next six months and a total of about 5000 in 18 months. The rarity of the operation does not seem to make much difference in the total requests. The green stamps will total about $350 and nearly all of it will be in the first 1500 cards. So you see I got it all figured. I'm gonna go to Clipperton, work those first 1500 and quit.

K3RLY

MARS



Harry Simpson A4SCF
c/o 73 Magazine
Peterborough NH 03458

Due to the lead-time necessary for publishing a national magazine, I am something like the moth – living in bathing suits in the winter and fur coats in summer! While still untangling the loose ends of last year, I must concentrate on new plans for making 1973 a banner year for all concerned with the various MARS programs! Let me begin with an apology for the delay in answering some of your letters. When Alice and I returned from our extended vacation we were presented with a stack of more than *two hundred* individual letters requesting MARS information! This, of course, in addition to our regular correspondence which normally runs about ten letters per day.

After the apology – thanks! Not only thanks to those of you who requested the information – but to

those wonderful members of Air Force and Navy-Marine corps MARS who volunteered information on their programs – I don't know what I said to bring on such a response – but I'm glad! For the first time since the beginning of this monthly effort I have actual proof that there *are* other programs than Army MARS!

First, a letter from W4NGU/3 with an outstanding proposal for CAP-Air Force MARS Coordination; next a friendly letter from Navy MARS member NØRRN (WB5AWA) listing these frequencies and times:

Transcontinental RTTY Traffic Net:

13,975 kHz, 100 wpm, about 11 AM CST

Eighth District Nets:

7375 kHz, SSB-CW, 24 hours

7495 kHz, RTTY, 60 wpm, 2300Z

4010 kHz, Louisiana Traffic Net, 0100Z daily

He also included a copy of DNC 8 (A), Mission and Policy – more about that later.

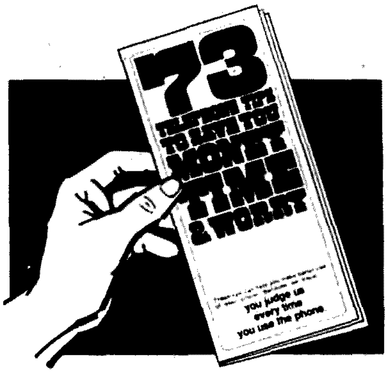
A Navy MARSgram from Canal Zone Area Coordinator NØGCZ: Canal Zone Navy MARS activity on upswing with daily circuits to the United States on TTY, CW and SS8. Phone patches will soon be routine but message traffic is our current speciality. If you want to send a message to the Canal Zone any MARS station should be able to route it. Two meter activity is also growing.

The message was forwarded by New Hampshire and Vermont Coordinator NØGBF, Karl W. Miles, Pead Hill Road, Wilton NH 03086. Another very nice letter from Bill Karabinus WA6RAM/NØQMY, listing west coast frequencies and times, and introducing 11th NAVMARCORMARS District Director Jack Hughes, 937 North Harbor Drive, San Diego CA 92132 – who can give full information on the program in that area.

AF7EJD, AFBØGSY and AFC4DTY all wrote very nice letters introducing Air Force Public Affairs Coordinator J. Harvey McCoy AF2IYX, 109 Willow Ave., Huntington NY 11743. Each gentleman added other information which will be passed along to you in the future. Finally, a letter from a fellow Army MARS member AD9SKU, Bob Ruggley of Cicero IL, with many kind words about our effforts – and, of all things – he enclosed eight (count 'em) 8-cent stamps to help out on our expenses! A feller like that should be rewarded, so I'm going to use one of the stamps to return the others!

It was a tough struggle, but we're finally off the ground, with contacts made for information from each of the MARS services. The mail has all been answered, the sun is shining, and all is right with the world! If you need information about Army, Navy-Marine Corps or Air Force MARS, I am now in an excellent position to supply it, and I promise to answer all letters promptly – at least until next vacation! Sincere thanks to each of you who took the time and effort to write – may your New Year be the best ever!

A4SCF



A WORRIED COMPETITOR?

Contrary to all the rumors, 73 has NOT annexed the telephone company. Even with the tremendous growth we have been experiencing, the task of doing such a thing is beyond our means . . . for a while.

But Ma Bell is worried! Not only have they started published a special interest magazine (see above), but their cover gives you that something-looks-awfully-familiar feeling. In addition, we recently received a copy of a top-secret executive memorandum calling for a dispatch of agents whose missions were to bring back FM and IC construction projects! (We *wondered* why that last visitor had such a questioning look on his face when he heard the word "antenna.")

In the face of all this we will make a prediction: Not only will we stand to meet the challenge that has been made – you can be assured that the second issue of this preposterous publication will never meet the presses.

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73 GOES METRIC

Now that the U of S has decided to go metric, the very least 73 can do is try to keep up – and perhaps prod the other ham magazines into following suit – as they did with the acceptance of the IEEE standards, etc.

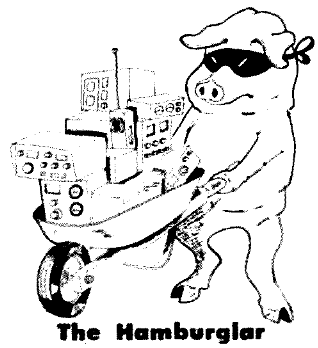
Besides that, we are already partly converted to metricity – right? Not too many of us have been active on the 250 foot band lately, though many are busy on the better known 75 meter band. Ditto the 70 footer, popularly designated 20 meters.

It will take a while before all of our articles are settled into the new nomenclature, but we'll try to convert as quickly as we can. Oh, there will be some areas that will take a while – like the 6-32 screw and its compatriots. That 32 represents 32 threads per inch – and in cement mixers that comes to about 12.6 and that is not going to be popular. Do you suppose the day will come when we do shift to metric threads? Or even metric heads?

REMEMBER:

1 in = 2.540 cm

1 cm = 0.3937 in



The Hamburglar

STRIKES AGAIN!

Milton L. Mitchel K5LKL lost out to a bit of unethical Christmas shopping last month. The Cloaked Claus walked off with an Eimac AF 68 Ser. No. 10888, Eimac PMR 8 Ser. No. 10918, and a M1070 power supply. An RCA model AR88 with a non-standard S-meter was also taken. Please contact Milton at Section A, V.A. Center, Temple TX 76501.

A Trio TR2200 Ser. No. 241969 was also politely lifted from the locked automobile of Ed Pores WA2ZBV. Anyone with information can reach Ed at 16 Dorchester Drive, Manhasset NY 11030.

Yaesu FT-101 No. 107036	WA2YSW	4/72
Standard 2m FM No. 102703	W6NPV	4/72
Drake ML2 No. 20189	WB2LLR	4/72
Standard SRC-806M No. 009210	K1TLP	5/72
Aerotone 6M 355LT, No. 685064	RR Police Grd.Ctrl.Trml. NYC	5/72
Standard SRC-806M, No. 102703	C. Mathias 3234 Coronado Ave Imperial Beach CA	5/72
Lafayette HA-410 No. 009210	WA2KDG	5/72
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Swan Cygnet 270,No. 313022	K4ACJ	9/72
Collins Mic, Mod. MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B No. M-395430	W8HST	11/72

DX FOOTNOTES

Hello, "You-All", looks like it will be me running this column and the WTW Award from this date on. Let me introduce myself:
Name: Gus M. Browning
Call: W4BPD (and have signed well over 165 other calls from DX locations overseas.
Been A DXer since - Nov. 25, 1927
QSO's made: Total over 600,000
DXCC Nr. 4, WAZ Nr. 40, and lots of the other awards not all can be remembered.
Occupations: Editor & Publisher of The DXers Magazine, printer and Electronic Repair Shop.

Thats enough tooting my own horn. Plenty of time at later dates !

I need all the good, reliable DX tidbits, news, DXpedition plans, DX QSL info, and even any good photographs (in black and white - when possible) you may happen to have or get later on - They will to returned to you if you will mention "return to ???" on the back side of them.

You can send your info to me either at the address of this magazine or (to save time) send it to me direct at this address:
Gus M. Browning, W4BPD
Drawer "DX"
Cordova, S.C. 29039
Or if you run across something that's "red hot" and you think is important enough you could call me (please NOT COLLECT) at:
(803) 534-6485
You can call me anytime of day or night (as late as 2 o'clock A.M. - local time - I work that late every night here - 7 nights per week). In submitting info to me please keep in mind that I will have to have the news items in my hand no later than 3 days before the first of each month. This is being prepared on October 28th. as an example of how long before it appears in your magazine.

In case you havent heard yet, the year 1973 is being called "our year" by 73 magazine so Wayne (the "big boss") and I have come up with an award to celebrate, an award not too hard to make. All you have gotta do is to work 73 different countries in the first 73 days of 1973. We will call this something like "The 73 - 73 - 73 DX Award. So get the old rig ready to start on Jan. 1st, 1973. After you have worked your 73 different countries in the first 73 days of 1973 (thats the 14th of March) get three other hams to certify your log) send us the list of stations you worked, giving the dates and times, etc. of the QSO's. The Award may be either a nice certificate or lapel pin, maybe it will have a small "cost" tacked on to cover our cost or maybe even free (if Wayne can afford to lose on the whole thing !). Will let you know well in advance of the March 14th.

Future DXpeditioneers, prepare for "all events" because you will have "certain troubles" (other than the usual licenseing, customs, etc.) You will have QSL problems when you are back home, you will have a lot of such items as, time wrong, band wrong, even the mode and band will be wrong. Then you may have a "pirate" working the fellows at the same dates you are on, sometimes a few days before or after you are on. Be sure you have a good GMT watch or clock and set it right and be sure of your GMT date (this also goes for those back here working the DX stations, too). All the above came to mind when I received a letter from Jim, K9TZH after his operation at Market Reef, where he operated as OJØ SUF. A portion of the letter quoted: "OJØ SUF QSL INFO: Fellows I am very sorry that there has been such confusion regarding the Market Reef Expedition QSL's. When I left Finland, all was in order but since that time, problems have developed concerning financing the 6000 cards. Have just received a letter from OH2BHU, who stated that the cards have *finally* been ordered and will be coming out very soon. Anyone having problems getting a card for their QSO, please write me and I will do everything in my power to get the contact confirmed. This includes fellows who have received their own cards back marked "Not in Log".

I would like to emphasize this is not a request for $!"
Jim says in the letter, "if I had only knew then, what I know now". after mentioning other problems.
NOW FOR THE WTW AWARD
At the present moment all the info and present status of the WTW is in the hands of Dave, K2AGZ and I am QRX for him to send all the info, etc. down here so that I can arrange it all in the files and then get going on the project again. I hope to soon receive this all from Dave and get going again. I suggest that all confirmations be sent to me direct instead of to 73 Mag. It will be more quickly handled and be less chance of your cards being lost, etc. I do very strongly suggest that you send your cards by "certified" (cheaper), or via Registered mail and include enough (either stamps or money) to return your cards by "certified mail" plus of course the usual parcel post costs and naturally the WTW fee of One Dollar (to partly cover our costs). Be sure to list every card in the order they appear in the DXCC country list, giving date, etc. of the contact. Remember we will keep this list you send us. You had better make yourself up a duplicate list to keep for reference purposes at later dates when you add new countries to your standing in the WTW. Remember there are three awards, the WTW-100, WTW-200 and WTW-300 and these can be earned on CW and then the same for all PHONE. Will be telling you more about this from time to time.

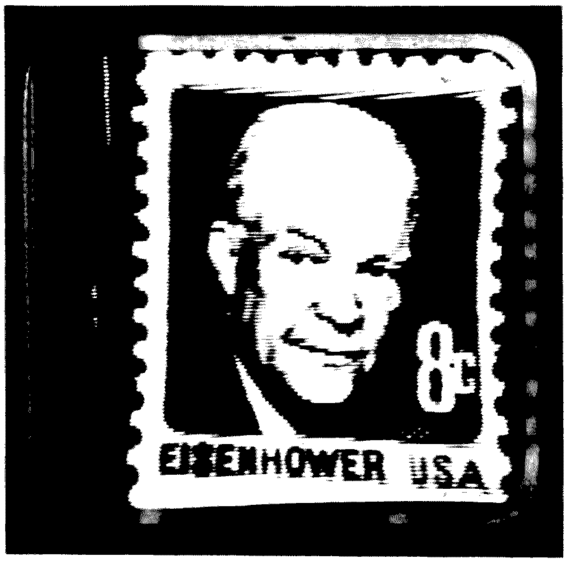
We are thinking about maybe giving nice Lapel Pins for the 200 and 300 plateaus of our WTW. I wonder when the ARRL will start something like this, too ? And while I am "wondering", why not also wonder about the overall viewpoint of DXing in general ? For instance, why not *more countries ?*, YES that's what I said "more countries" ! I have not met anyone yet who really has complained that there are "too many now". This word "countries" are used very loosely when refering to our DX awards. Except WTW, which stands for Worked The World, certainly a more descriptive group of words when talking about our kind of DX. I think it's time for Big Brother, the ARRL to do something about their DX Award set-up, give some pins for the 200 and 300 brackets, give us some new countries, cut that 250 miles separation between islands for a starter - OR - better yet - START SOMETHING BRAND NEW. (all of which I doubt they will do.) With computers being used these days even by some of my small grocery stores, I am sure that this could be done at a very reasonable price. They of course would be able to use the computer in many other ways when it is put in. This is nearly 1973 (73 Magazine's) and times are changeing rapidly and I think ARRL will have to do the same to "keep up to date" with the rapidly changeing world !

I know that I will receive many letters telling me to not "rock the boat", you can't fight the establishment, etc. My answer to these is all the same, Ole Buddy, you have your ideas and I have mine and if you want to "air" your ideas we have the "LETTERS" page in 73 for you to use (I also have "Letters to the editor" page or pages (if necessary in my little DXers Mag.) They are yours to use to let the other fellow have your viewpoints. All I want to do is to have MORE DX for the boys to chase, giving them something to do these long winter nights coming on us now.

I wonder if there are still some of you out there that have not yet tried makeing some of these new "gadgets" using these new IC's ? It took me ONE HOUR to build a very FB 10 meter pre-amp using a Motorola type 1590G and it gave a 50 db gain with less noise than I could hear from my Collins 32S-3. Have built up a number of very FB other little "goodies" (quite useful, "gadgets".) All which will get you started with Solid State, you may as well face it fellows, solid state is with us and the days of hot, noisy, inefficient, etc. is about over. You are never too old to learn !! 73 Magazine will give you plenty of these little "goodies" to build. Try a few of them and the Old Bug will bite you again and you will again become a ham like you used to be ! - Remember ??
That's it for this month,
73 es DX, de Gus BPD

SSTV PROGRAM

Presented by John Smith K3SLJ.



SOCIAL EVENTS and CONTESTS

CONTEST EDITOR NEEDED!

There is another aspect of amateur radio that we would like to cover regularly in the 73 newspages – contests and certificates. It is possible that we might be receptive if someone who was seriously into these things offered to keep the 73 readership informed.

We might even be able to add some pecuniary interest to your amateur radio hobby.

If you have better than average connections on keeping up with certificates and awards, and are interested in preparing capsule facts on them for the 73 newspages, drop a line to us.

Ditto contests. Readers would like to know what contests are being run, when and enough data to get started in them or send for full rules. We do want to leave CQ as the force for exhaustive details on contests and just bring a synopsis to 73. Anyone with good bona fides interested?

3RD WORLDWIDE SSTV CONTEST

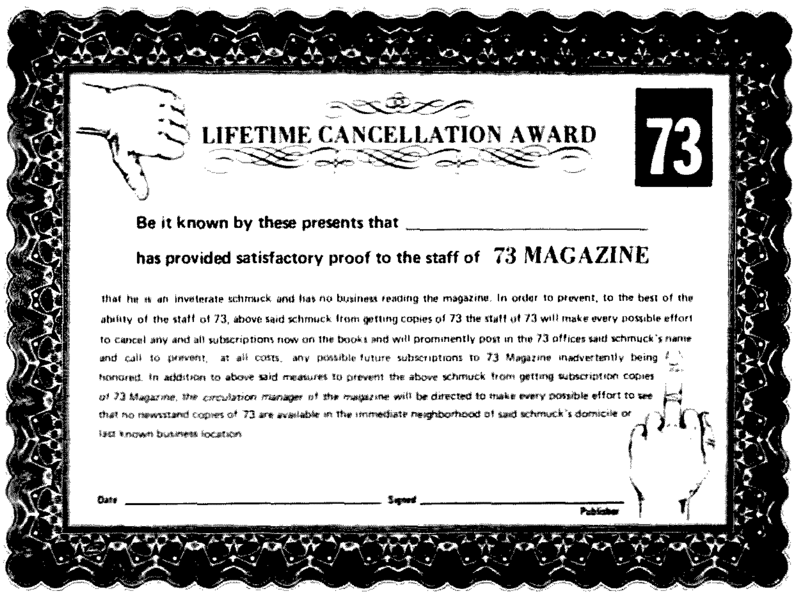
The third worldwide contest for SSTVers is being sponsored by cq electronoca Magazine. The operating times are 1500–2200 GMT Feb. 10, and 0700–1400 GMT Feb. 18. Plan to use all authorized frequencies on 80 through 10 meters. Each two-way exchange counts one point with a multiplier of 10 for each continent and an additional multiplier of 5 for each official ARRL country. The only exception is that each VE and W call area will count as a separate country.

Logs must contains Time (GMT), Frequencies, Data, Call sign, No. sent and received, Country multipliers, Points and final score. They must be received by Prof. Franco Fanti, via A. Dallolio 19, 40139 Bologna Italy before March 20, 1973.

NOTE: All contacts must be made via SSTV *only*. Use of any other mode of transmission before, during or after the Slow Scan exchange is not permitted, and will cause your log to become invalidated.

VHF CONTEST

Worlwide VHF Activity 1973 – 3PM local March 10 to 10PM local March 11. Purpose: To keep VHF bands active, allow rig testing, allow hams to get acquainted with fellow VHFers. Exchange call letters, county and state. Count contacts with mobiles in each county worked. Mobiles can work a station once from each county of mobile or portable operation. Let's see some mobiles. Scoring: Multiply number of contacts times number of counties worked times number of states worked. Awards: Certificate to each station scoring 100 points on six or 50 points on two meters. Certificate to the top station in each state regardless of score. This applies to each band of operation. Each band is a separate entry and a station can enter one or both bands. Logs should show time band mode and exchange info. Mail logs by April 15 to WA3NUL, Box 1062, Hagerstown MD 21740.



LIFETIME CANCELLATION AWARD

73

Be it known by these presents that ______________________

has provided satisfactory proof to the staff of 73 MAGAZINE

that he is an inveterate schmuck and has no business reading the magazine. In order to prevent, to the best of the ability of the staff of 73, above said schmuck from getting copies of 73 the staff of 73 will make every possible effort to cancel any and all subscriptions now on the books and will prominently post in the 73 offices said schmuck's name and call to prevent, at all costs, any possible future subscriptions to 73 Magazine inadvertently being honored. In addition to above said measures to prevent the above schmuck from getting subscription copies of 73 Magazine, the circulation manager of the magazine will be directed to make every possible effort to see that no newsstand copies of 73 are available in the immediate neighborhood of said schmuck's domicile or last known business location.

Date ______________________ Signed ______________________ Publisher

NEW CERTIFICATE AVAILABLE

Now and then – it certainly doesn't happen often – but occasionally someone of particularly low moral turpitude manages to become a subscriber to 73. The Lifetime cancellation award is reserved for those who, by their rottenness, richly deserve it.

None have yet been issued; however several amateurs are definitely up for serious consideration. Unless psychiatrists are able to give them emergency mental repairs, these sick-o's will be early winners.

WHEATON HAMFEST

The Wheaton Community Radio Amateurs will hold their 11th annual Mid-Wanter Swap and Shop on Sunday, February 11, 1973 at the DuPage County Fairgrounds, Wheaton, Illinois. Hours: 8:00 AM to 5:00 PM. $1.00 Advance/$1.50 at the door. We are expanding to two buildings this year. Refreshments and unlimited parking. Bring your own tables. Free coffee and donuts 9:00 – 9:30AM Hams, CB'ers, *electronic* hobbyists, friends and commercial exhibitors are cordially invited. Write W.C.R.A., Bill Rambox, WB9AVD, P.O. Box QSL, Wheaton, Illinois 60187 for information.

TROPICAL HAMBOREE

Announcing the upcoming Tropical Hamboree/ARRL Southeastern Division Convention Jan 20–21, 1973, at Miami Municipal Auditorium, 499 Biscayne Boulevard, Miami, Florida. Further information may be obtained from Evelyn D. Gauzens, W4WYR, Chairman, c/o Dade Radio Club, P.O. Box 73, Biscayne Annex, Miami, Florida 33152.

BRISTOL 73 ACTIVITY CONTEST AND AWARD

Contest to run from 1st January 1973 to 31st August 1973, and is open to all licensed radio amateurs in the world, who are invited to make contact with Bristol, England. Bristol is defined as within Postal Districts 1 to 20 inclusive (BS1 to BS20).

A case of sherry donated by a famous firm of Bristol wine merchants will be presented to:

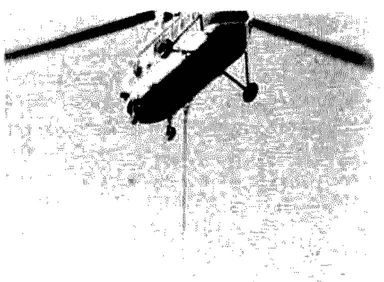
1. The highest scoring station outside the U.K. call areas.
2. The highest scoring station within the U.K. call areas but outside Bristol.
3. The Bristol station making the largest *number of contacts* with participating stations.

COLLINS UPDATE

To cover the new phone frequencies without having to switch down to the next lower 200 kHz segment on your rig, replace your hf oscillator crystals with the following: 80M-6855 kHz, 40M-10255 kHz. This will allow you to tune 200 kHz segments of 3700–3900 kHz and 7100–7300 kHz. *Thanks to W4NJF.*

.52 SIMPLEX?

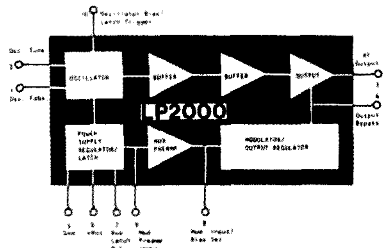
The IRC bulletin announced the topic of .94 repeaters with the heading "KA-BAM!" And that's about what happened at the council meeting October 15, 1972, at Michigan City. Many points about the pros and cons of .94 repeaters were brought out, and opposing viewpoints were heard from simplex and repeater operators alike. It might be best said that no one really knows the ultimate solution, but the Council has voted to endorse .52 as the national calling frequency (as have other states), and .46 as the Indiana spx. channel to be used as an alternative to .52 and for emergencies. While this does not solve the .94 problem, it at least takes the pressure off the Council to act in a negative direction, and is a hint to simplexers that .52 and .46 are good alternative choices to .94.



What a way to install an antenna! This Wilson Beam was recently installed by Peter Williamson in Augusta, Maine. He reportedly had to remove a tree for complete clearance. What did he use for that . . . dynamite? (Kennebec Journal photo by Veilleux)

NEW PRODUCTS

TRANSMITTER ON A CHIP



Someone eventually had to do it – and they did. Lithic Systems has announced a complete AM transmitter on a tiny IC chip. Designated the LP2000, it is capable of 50 MW output on 10 meters when fed by a 12V supply. Operation on 6 meters is also possible with slightly reduced output.

The block diagram shows that the chip isn't a simple oscillator/modulator as you might expect. Not only does it have two buffer stages between the oscillator and output stage, but it incorporates a power supply regulator and an audio preamp that is sensitive enough to be driven by a small speaker voice coil. Pretty sophisticated for an AM transmitter! T/R switching is accomplished by a latch trigger so the circuit can remain connected to its power source at all times.

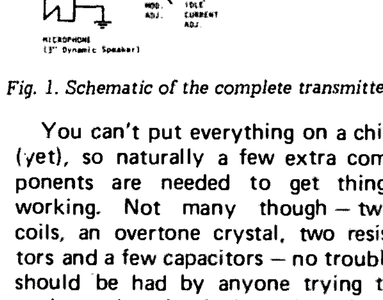


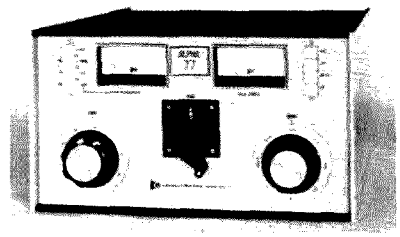
Fig. 1. Schematic of the complete transmitter.

You can't put everything on a chip (yet), so naturally a few extra components are needed to get things working. Not many though – two coils, an overtone crystal, two resistors and a few capacitors – no trouble should be had by anyone trying to package the circuit in weird places (like your wristwatch . . .or an enemy's ham sandwich!). No kidding, this little transmitter is bound to start showing up everywhere as a bug. Another possibility is a remote burglar alarm small enough to mount right inside a door knob! Power requirements are +5 to +15V so those tiny, aspirin-size batteries are a natural for the power source. Current drain at 12V is 28 mA.

Lithic Systems is hard at work developing VHF FM and even SSB transmitters similar to this one. *Those* are certainly going to revolutionize things. Who is going to manufacture the first 2 meter FM nameplate?

Contact *Circuit Specialists, Box 3047, Scottsdale AZ 85257* or watch their ads.

POWERHOUSE



The ALPHA 77 has got to be *the* linear for the discriminating amateur who demands quality and perfection for his shack. It is not just an ordinary linear built for ordinary ham use. It features heavy duty construction and is designed to operate at 3000 watts PEP phone input on a continuous duty basis. At the legal limit of 2000 watts (taking into consideration the intermittent type of service that occurs in the normal SSB operation) this amplifier is practically snoozing.

It employs a single Eimac 8877/3CX1500A7 ceramic-metal, grounded-grid triode that is air cooled by a computer grade thermostatically controlled blower. This tube has a rated dissipation of 1500 watts and can be driven to the limit for ham use by only 50 watts of drive. This makes it compatible with practically any exciter on the market.

The overall design stresses safety and sensible operation. When turned on, a step-starting relay system gradually applies power to prevent current surges and relay arcing. To keep everything in check while operating, full metering is provided. Besides the 10A meter for continuous monitoring of plate current, a second meter can be switched to read plate voltage, grid current, and forward or reverse rf power output. Yes . . . the ALPHA 77 has a built-in direct reading 0–5000W wattmeter! An additional feature is the grid excess current circuitry. The grid relay automatically kicks-out when the final tube is either over-driven or underloaded. Besides assuring full tube life, the relay also protects against accidental flat-topping and a possible blown input circuit.

Continued on page 136.

AMATEUR RADIO AND THE I.T.U.

A. Prose Walker, Chief
Amateur and Citizens Division
Federal Communications Commission

Mr. Walker's speech was given before the Pacific Division Convention, ARRL, October 15, 1972 at San Mateo, CA, and at the Southwestern Division Convention, ARRL, October 21, 1972, at Santa Maria CA.

Although there are many other subjects of immediate importance to amateurs, I would like to discuss today the question of the allocation of amateur bands. There is no more urgent and time-consuming task, in my opinion, than this one. And although the mechanics of the next step in the process have not yet been brought out into the open, that is no reason not to begin our preparation for what could be the greatest opportunity amateur radio will have in your lifetime and mine to obtain additional amateur bands in the HF region from 3–30 MHz.

We are not yet at the point where any phase of amateur radio can be substituted for the activity handled on a daily basis on our main bands from 80 through 10 meters. I'm not sure that any phase could or should be a substitute for this. If those bands were taken away, we might or might not survive. For as long as I have been an amateur, the philosophy of our approach to allocation conferences has been primarily one of defense of our existing bands; essentially a negative philosophy.

Over the years, our allocated bands have been gradually whittled away:

160 meters taken away as an emergency war measure 31 years ago and returned only in minute amounts since then;

Eighty meters shared with broadcasting, fixed and mobile and except in Region 2, drastically reduced in width as an amateur band.

Forty meters has become such a shambles of its former self that it is hardly recognizable anymore as an amateur band . . . as indeed it is NOT except during certain times of the day and seasons of the year and sunspot cycle. We have 300 kHz to use, if we can, but the rest of the world has only 100 kHz *"exclusively amateur."* Listen some morning, wherever you live, and see how "exclusively amateur" it is from 7000–7100 kHz.

In 1947 at Atlantic City we lost the top 50 kHz of our *twenty meter band* to the Fixed Service, and in certain countries of the world they also use from 14250–14360 officially and other parts of the band, unofficially.

Fifteen meters is definitely a PLUS on our side but it hardly makes up for all the other minuses we have incurred over the years . . . we got the eleven meter band and then lost it to the Citizens Radio Service.

Ten meters is probably in reasonably good shape, but we did lose the top 300 kHz at Geneva in 1959, primarily to the meteorological service for their high altitude weather balloons.

The World Administrative Radio Conference (WARC) held in 1959 was the last one to deal with the allocation of the HF spectrum on behalf of all the various services. There have been individual service conferences since then, but they have not been empowered to re-allocate or reassign except within the bands of frequencies already in the table of allocation contained in the International Radio Regulations. The head of the United States delegation to the 1959 conference was the late FCC Commissioner T. A. M. Craven, an engineering expert who had grown up with the telecommunication industry. He was not an amateur himself, but he had associated with many throughout his career. He had a keen understanding of the value of amateur radio to our country. It is a tribute to Commissioner Craven that the amateur service fared as well at that conference as it did. We might well have lost 200 kHz of 40 meters, and 240 kHz of 80 meters, had it not been for his foresight in handling the negotiations on those bands.

I hope that by now, you and I are in the same situation as the farmer and the mule which he had to hit across the head with a two by four in order to get his attention. If I have your attention, let me discuss with you my appraisal of the frequency allocation picture for the Amateur Service. I shall go into detail how frequencies are obtained and what should be expected of amateurs whenever a reallocation conference is called by the ITU. I shall predict the amateur population by 1980 and the amount of spectrum that will be required to accommodate them. If I seem to lend a measure of urgency to the subject, it is intentional, *because I believe the subject is terribly important to amateur radio worldwide.* If I can convince you, perhaps through your agreement, you can initiate appropriate action through your representatives.

A short time ago we were asked to predict the number of amateur stations in the world by the year 1980. This is difficult if for no other reason than the fact that we don't really know how many we have at present. Such figures are quite vague for certain countries of the world. Also the prediction depends on the assumptions you make as to what factors influence the growth and in what proportion. The factors are different in various countries. I won't attempt to go into detail. We know that in certain countries there are rather startling increases in the number of amateur stations. We think we know what has brought about such increases, and what might do the same in our own country. Taking these aspects into

consideration and using some black magic, we arrived at a worldwide amateur population figure for 1980 of between 600,000 and 800,000. Even allowing for some discrepancy in these figures, it is obvious that if anywhere near that number of amateurs has access to our bands around 1980, particularly the HF bands, there is going to be much greater congestion than we have at present. Suppose we increased the amateur population of just the United States by around 50%, what do you think the bands would sound like on a weekend? Add to that figure another hundred thousand or so amateurs scattered around the world, and I think you will agree that we could have real QRM at peak operating hours. Please don't draw any wild conclusions from this discussion that the FCC is about to do something drastic that will cause the growth of amateur stations to mushroom, as it did in the Citizens Radio Service from around 40,000 licensees in 1958 to a present total figure of about 815,000.

The most obvious solution to any problem of frequency congestion is additional frequency space. Let's examine what is involved. Do we say to the FCC,

> *"We need more spectrum... how about assigning another 100 kHz on the top end of twenty meters?"*

No, the FCC can't do that because this is an international problem that can be solved only through the I.T.U. The United States is one member administration of that body. What is the mechanism of getting our 100 kHz? First a World Administrative Radio Conference must be called under the provisions spelled out in the Montreaux Convention. Is that apt to be done? I say yes, but don't ask me exactly when. *But whenever it comes, we must be ready and that takes a long time.*

How do amateur frequency bands get established and put into the Table of Frequency Allocations? Member countries of the I.T.U. such as the United States, Australia, New Zealand, Japan, the Soviet Union, France and any others, submit proposals for utilization of any part of the spectrum under consideration. These proposals are determined *individually* by each country and submitted in advance of the conference to the I.T.U. At the conference, an allocation committee is formed, which is further divided into sub-committees to consider the previously submitted proposals for use of particular portions of the spectrum.

You can readily understand that if a majority of the members of such a committee are in favor or against a proposal, its chances of success or failure are correspondingly equivalent. How do we get enough countries to agree with the amateurs' position seeking more allocations? *We start well ahead of time and obtain concurrence of governments* throughout the world *prior to the conference,* to *include the spectrum needs of the Amateurs in their proposals to the I.T.U.* This certainly includes our own government which has consistently championed the cause of Amateur radio throughout the years. It also includes as many other countries as possible, because decisions are taken on the basis of a majority vote. *Without support in committee and votes on the floor, the proposal fails of adoption.* It's that simple.

Is such an endeavor within the potential of radio amateurs? Again I say yes. It won't by easy, and there's no guarantee of success. But I keep repeating that we *can't afford not to do it!* If there was ever a golden opportunity for Amateurs to do something about their HF allocations, NOW IS THE TIME.

In all likelihood, there will be another WARC dealing with the HF spectrum within the current decade. If not, derogations of the Treaty may pre-empt portions of the spectrum before a conference can be called. Let's just assume that we might have one within the next 6 or 8 years. What should we do between now and then? Is it too soon to be stirring ourselves? I think not. Let me tell you why.

You all know, with the advent of satellites, what has transpired in telecommunication during the past decade. Many services are in the process of transferring their operations from the HF spectrum to the GHz spectrum of satellites or onto cables. Notable among these is the International Fixed Public Service which is transferring its operations about as fast as feasible. Others include the Maritime and Aeronautical services in varying degrees. The reason, reliability. Who will occupy the portions of the spectrum which inevitably will be vacated by many of the Fixed Service transmitters? Probably a host of users not yet evident will file claims on the spectrum, plus the *many countries* which *still require HF* because they have no cable terminal nor an earth station for satellite operation. *Those who are successful in obtaining spectrum space at the next WARC will be those who have prepared their positions carefully with convincing justification . . . a professional effort* worthy of consideration at highest levels of government. It won't be a "shoo-in," believe me. Undoubtedly the HF broadcasters will be after additional space . . . something like ten bands 500 kHz wide. What should be amateur position be, both domestically and internationally? It has to be the same, because our HF bands all have long distance progation characteristics in varying degrees depending on propagation phenomena.

What I shall now propose is not an FCC plan, but one that I personally would suggest as a desirable approach. You may call it what you will, but I emphasize it has no sanction by the FCC. It has five major points.

First, I urge that the *amateur satellite program be expedited* with the goal of having a near-synchronous, "semi-professional" amateur satellite in orbit during the early part of 1976. Without going into the many details involved, this could have a tremendous effect on many nations of the world. If you have the "bird" operational, a team of competent amateurs with a portable earth station could travel to selected countries for demonstrations and educational purposes, bringing to their realization what amateur radio can do for them through their young people. Use of the amateur satellite would be a most dramatic means of calling this to attention. Aside from the educational benefits of the satellite in amateur communication, such a program would almost certainly make friends for the Amateur Service . . . something which we need desperately as evidenced at the last WAR-ST. I repeat, the ITU makes its decisions via the voting route, and the United States has 2 votes; one for the U.S. proper and one for the Territories. When the chips are down, *it's the votes that determine who gets what and how much!* No majority in the voting, no allocation.

Second, I would formulate a high frequency allocation program for our future needs, assuming that the prediction figures I mentioned earlier will prevail. In this let's not be mice, let's THINK BIG! *Perhaps we won't get all we want, but let it not be because we didn't try!*

a) Let's get 160 meters returned.

b) Work out a program aimed at making the entire 3.5–4.0 MHz band *exclusively amateur, worldwide.*

c) Work closely with other users of the spectrum in the area of 7 MHz, especially the HF broadcasters, and make a tough, determined effort to not only unpollute our existing 40 meter band, but expand it to encompass 7000–7500 kHz, *exclusively amateur, worldwide.* It's just possible that under some conditions, HF broadcasting would vacate our 40 meter band.

d) Go after a new exclusive amateur band from 10.5–11.0 MHz.

e) Work for expansion of 20 meters up to 14.5 MHz on the high end, but at the very minimum attempt to

obtain the return of the 50 kHz we lost in 1947 . . . all of it *exclusively amateur.*
f) In the area of the spectrum from 17–20 MHz there are 2.3 MHz now allocated to the Fixed Service. How about a new band in this area from 17.5–18.0 MHz?
g) Although 21 MHz is not as critical as some others, at times it gets congested. Why not try to expand it up to 21.5 MHz on the high end. This would be at the expense of HF broadcasting, but they might agree to slide up the spectrum an equivalent amount.
h) In the area above our 15 meter band, there is almost 2 MHz now allocated to the Fixed Service. Why not go after a band from 23.5–24.0 MHz.
i) Ten meters is wide enough and I would not suggest any further expansion there with the possible exception of getting back the 300 kHz we lost previously.
If we could obtain the foregoing, we would have *bands about every three MHz throughout most of the HF spectrum,* and could follow the propagation curves as the MUF changes throughout the day and night.

Third, we should be *organizing a professional domestic, U.S. team* to investigate and coordinate information on specific areas of the spectrum; analyze data that could be obtained on utilization of assigned allocations by the various services; dig out information on new potential users of the HF spectrum that may not have come to the surface yet; *prepare a professional position paper for use at the appropriate time* within this country; and work thoroughly, with the foregoing as a basis, throughout the preparation period when the position of the United States is being formulated. That time has not yet come, but when it does *we should be ready to participate armed with proposals, facts, and figures,* insofar as possible to get them, in support of our desires. That is the only way to deal with professional allocation people, who are notably lacking in sympathy when it comes to allocation of the spectrum.

Fourth, extraordinary effort should go into *liaison and coordination* of whatever program is agreed upon, with the most influential and important IARU member societies. The same goals, if proposed throughout the world on a coordinated basis could accomplish much more than a haphazard effort, no matter how well prepared the program might be. *If even a dozen of the 125 countries which usually take part in such deliberations,* would propose the same program for amateur allocations *it would* auger well for success. The *important thing is to obtain each country's acceptance of the amateur position prior to submitting its national proposals to the I.T.U.* Usually, once a delegation gets to the conference it is too late to change position. This simple statement of affairs is miles from its accomplishment. It would require at least one and perhaps several teams of people to travel throughout the world to explain and urge the adoption of the position to IARU people, and provide them with assistance in justifying the program to their own governments. No one but amateurs in individual countries can do that job. *We have well known people in our ranks – use them!* Maximum assistance should be given them through prepared material which could form an equivalent basis for justification that we would use in this country, or modified as circumstances indicate desirable. Certainly conditions and viewpoints will undoubtedly be different in various countries of the world, but that should not dampen our effort, *merely sharpen our perspective.*

And finally, our selected group of amateur experts, *professionals in telecommunication,* should be our representatives at the WARC. As many as reasonable should attempt to be appointed to their national delegations for purposes of liaison with their own governments. The composite team should be directed by someone with experience in international allocation matters, such as Tom Clarkson of New Zealand, ZL2AZ, so that a coordinated team effort can go into the conference work itself, in the committee and sub-committee discussions, all *on a professional level,* to the credit of the Amateur Service.

The program I have outlined may not be acceptable in all details to everyone, but at least it could be a beginning of the formulation of a program. It would take money. It would need professional manpower. It would require time. And above all it would need confidence in the purpose of the effort, with sufficient desire to succeed and an understanding of the difficulties to not become discouraged when the going got rough. In my opinion, the result will be a measure of the amount of effort which the amateurs of the world are willing to put into it. There is no guarantee of success in any degree. But if we are ever to have a chance to obtain additional HF allocations, it seems to me the time to begin is NOW!

You may well ask the question:

> "What is the alternative if we do not obtain additional spectrum space and our population expands as predicted?

There is no answer that any one individual can provide, and however it is answered it would have to go through rule making procedures of the Commission. But I think it is only logical to conclude that as the number of amateurs using wide-band emissions increases, something will have to be done to reduce the interference potential of amateur signals. There are several avenues of approach. One might be to reduce power in particular ways for various classes of stations. Another might be to reduce the occupied bandwidth, giving some kind of incentive to the signal which occupies the least practicable amount of the spectrum. Another would be to reduce or eliminate wide-bandwidth emissions, or restrict them to the highest class licensees, as was formerly the case on 75 and 20 meter phone. We probably should encourage more CW even though many people consider that to be an archaic form of communication. But a *CW signal occupies the least amount of spectrum and if we get too numerous for our existing bands, as we now use them, it might be that CW would again become the primary mode of communication,* rather than SSB. I might say that we well may be approaching this condition now. Certainly we see no technological breakthrough on the horizon which is of the same magnitude as the single-signal receiver of 40 years ago; or single sideband which was made popular shortly after WW-II or other development of like nature.

I consider it my responsibility to have pointed these matters out to you today, and I urge serious consideration by your representatives of the proposed action. The talents among the amateur ranks are more than adequate to achieve the degree of professionalism required for this task. It seems to me, that they must be sought out and used, not on the basis of winning a popularity contest but because they are professionals and therefore what they can do *for* amateur radio.

The other day in doing some research on the evolution of spectrum management, which I shall discuss before the Radio Club of America in New York City, I ran across a statement which was used to describe the results achieved by the United States at the recent WARC-ST. It is so apropos to my thoughts on the subject I have discussed that I would like to quote it here:

"Although the United States went into the Conference with strong opposition to some of its proposals, the results were most favorable and proved the value of thorough preparation, advance coordination and a delegation composed of experts in all facets of telecommunications."

SNEAKY FCC PROPOSAL TO END AMATEUR RADIO*

The FCC almost got one by all of us! And this one is a beaut. This proposal would make it extremely difficult to put up a tower or a mast for your antenna. Anything over 20 feet above your house would require a lot of paperwork, authorization, an okay from the neighbors – the works.

The deadline for official comments has passed by, but we are asking for an extension of the comment time since this docket was not sent to us when it was released and amateurs have had no opportunity to see or consider the impact of this far reaching docket.

I want to thank Steve Murray K1KEC for bringing this corker to our attention.

Read through the text, please. Talk about it at your club – and file a comment. Please, please file a comment. Amateur radio comes under the Safety and Special Radio Services – so this docket means US! If this docket doesn't get you excited then you need some help to get you back to life again. It is so incredible that it seems like a bad dream – but it is here and it is about to be passed into law.

PETITION: **To extend the time for comments on Docket 19555 until February 28, 1973.**

This docket, which proposes profound changes in the whole fabric of amateur radio, has not been brought generally to the attention of radio amateurs and they have not had an opportunity to understand or comment on the docket. This is manifestly unfair.

In order to permit the publication of the entire text of the docket and allow time for its delivery, reading, discussion and comment, much more time is needed. The next issue of the amateur radio magazines in which the docket could be published would be received in January. This would make a cutoff date for comments of February 28, 1973 practical.

Please extend the time for comments on this docket.

Filed by Wayne Green W2NSD/1

Docket No. 19555

In the Matter of Implementation of the National Environmental Policy Act of 1969 – Notice of Proposed Rule Making – Adopted July 24, 1972; Released August 1, 972 – By the Commission: Commissioner Johnson concurring in the result; Commissioner Hooks absent.

1. Our purpose herein is to implement the National Environmental Policy Act of 1969, 42 U.S.C.A. 4321-4347, and particularly Section 102(2)(c) of the Act, 42 U.S.C.A. 4332(2)(c). (Heretofore, the Commission has considered environmental factors on a case-by-case basis, pursuant to an initial policy judgment that this was the better and more appropriate means of implementing the statute, in view of the relatively limited environmental impact of Commission actions. Though we have not decided many cases in which environmental questions were at issue, such questions have been considered when they were present. See, e.g., Amendment of FM Table of Assignments, 25 F.C.C. 877, 1970. In the light of recent court decisions, however, we have reassessed our initial position and are now persuaded that it is advisable and desirable to issue specific implementing regulations.)

2. In drafting the rules, careful consideration has been given to Guidelines issued by the Council on Environmental Quality. In its regulatory activities, the Commission approves or disapproves of applications which may involve construction projects by others which may have a significant effect on the quality of human environment, but does not itself engage in construction activities. In processing the hundreds of thousands of applications which are filed during a given year, it is almost totally dependent on information furnished by the applicant and others. Whether the criterion is efficiency, practicality or fairness, it is preferable to have all of the information and arguments from all interested persons before a judgment is made. This is particularly true of many environmental considerations, which have only recently been introduced as factors in the decision-making process. Thus, we propose (where there appears to be significant environmental effect) to transmit the application and related papers (including an environmental report prepared by the applicant) to the expert agencies, and to elicit environmental comments from those agencies and the public on the basis of those materials. A detailed environmental statement would be prepared following submission of agency and public comment. This seems to us the best way to assure full and fair consideration of the question of environmental impact.

3. Our purpose has been to fully implement both the letter and spirit of the environmental statute, consistent with procedural safeguards set out in the Administrative Procedure Act and the Communications Act, and with no greater application processing burden or delay than is necessary. The rules provide for the regular input of environmental data which will facilitate the identification and considera-

**As we now know it.*

tion of environmentally significant factors. They provide for comment by interested individuals and organizations and by expert governmental agencies, and for their participation in Commission proceeding. They provide for the consideration of environmental factors at the same time and in the same way as other factors pertinent to a public interest determination are considered, except that they provide for the preparation of a "detailed environmental statement" following comment by interested persons and expert agencies and prior to action, as required by the environmental act.

4. The rules apply to applications involving construction. Attention is directed to the fact that the Commission has not for some years required applicants for authorizations in the Safety and Special Radio Services to file an application for authority to construct prior to construction of station facilities. See Section 319(d) of the Communications Act, 47 U.S.C. 319(d). In those services, therefore, the proposed rules are made applicable to applicants and applications for station authorizations rather than applications and applications for authority to construct. For the most part, it is anticipated that the approximately 550,000 Safety and Special applications filed annually would involve minor construction having no significant environmental effect. However, Safety and Special applicants should consider environmental factors prior to construction, since construction without prior consideration of the environmental consequences and Commission authorization would prove fruitless if the Commission should subsequently find it necessary to deny the application for license on environmental grounds.

5. Authority of the proposed rules is contained in Sections 4(i), 4(j), 303(r) and 309 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 154(j), 303(r) and 309, and in the National Environmental Policy Act, 42 U.S.C.A. 4321-4347.

6. Pursuant to applicable procedures set out in Section 1.415 of the Rules and Regulations, 47 CFR 1.415, interested persons may file comments in this proceeding one or before September 29, 1972, and reply comments on or before October 30, 1972. In accordance with the provisions of Section 1.419 of the Rules and Regulations, 47 CFR 1.419, an original and 14 copies of all comments and reply comments shall be furnished the Commission. Comments and reply comments will be available for inspection in the Commission's Broadcast and Dockets Reference Room. All relevant and timely comments and reply comments will be considered by the Commission prior to final action in this proceeding. In reaching its decision, the Commission may take into account other relevant information before it in addition to the specific comments invited by this Notice.

Federal Communications Commission
Ben F. Waple
Secretary

APPENDIX

Part 1 of Chapter I of Title 47 of the Code of Federal Regulations is amended by adding a new Subpart I, to read as follows:

Subpart I – Procedures Implementing the National Environmental Policy Act of 1969.

§ 1.1301 *Basis and Purpose.*

The provisions of this subpart implement the National Environmental Policy Act of 1969, 42 U.S.C.A. 4321-4347.

§ 1.1303 *Scope.*

The provisions of this subpart apply to all applications filed with the Commission involving the construction, abandonment, or razing of a structure. They also apply to applications for license for new or modified facilities in the Safety and Special Radio Services. The term "application (or applicant) for authority to construct," as used in this subpart, shall encompass the abandonment or razing of a structure and an application (or applicant) for license for new or modified facilities in the Safety and Special Radio Services.

§ 1.1311 *Notice of proposed construction.*

(a) An applicant for authority to construct is required to provide notice to appropriate persons or organization if it appears to him, or to the Commission upon review of his application, that the proposed construction is likely to involve a significant environmental problem and that notice is likely to provoke comment which would be helpful in assessing the effect of the proposed construction on the quality of the human environment. The notice shall state the nature and location of the construction and shall invite comment to the applicant on environmental considerations.

(b) Where notice is required and written comment is requested. 30 days shall be allowed for comment. Comments received shall be considered by the applicant in assessing the effect of the proposed construction on the quality of the human environment pursuant to the provisions of § § 1.1313–1.1317. In normal course, notice should be given, and procedures for the consideration of environmental effect should be completed, before the application is filed, and written comments pursuant to the notice should be submitted to the Commission with the application. However, the applicant may, upon a showing of good cause, defer notice until after the application is filed. In that event, the applicant shall state in his application that he is seeking comment on a deferred basis, and action on the application will be deferred until applicant has given notice and complied with the provisions of § 1.1313, § 1.1315, or § 1.1317, as appropriate.

(c) The form of the notice and the persons or organizations to whom it is given will vary depending on the nature and scope of the construction project. The environmental effect and the sources of useful comment could be strictly local or could extend to a number of States. In a given case, for example, it could be appropriate to post notice at the site, to discuss the matter orally with neighboring property owners, or to raise it at a meeting of a community group. In another, newspaper or broadcast station notice could be appropriate. In still another, it could be appropriate to contact State or Federal environmental organizations and Government agencies which may reasonably be considered to have an interest in the environmental effect of the project. The form and extent of notice is left to the judgment of the applicant, subject to review by the Commission.

§ 1.1313 *Applications entailing expenditures of less than $100,000.*

(a) If an application for authority to construct entails expenditures of less than $100,000, if the applicant has considered the matter and has concluded that the construction will have no significant environmental effect, and if the applicant has received no significant objection to the construction proposed in the application, he may, as an alternative to filing a preliminary or detailed environmental report (see § 1.1315 and 1.1317), submit with his application a simple statement to that effect: *Provided, however,* that this paragraph shall apply only where prior public notice of the filing of the application is given by the Commission. See 47 U.S.C. 309(b).

(b) The Commission may, upon review of an application filed in accordance with paragraph (a) of this section, require the submission of a preliminary or detailed environmental report.

§ 1.1315 *Applicant's preliminary (short form) environmental report.*

(a) Except as provided in this paragraph, all applicants seeking authority for construction (and all applicants seeking authority to discontinue, reduce, or impair service to a communi-

ty, or part of a community, which involves the abandonment or razing of a structure owned or utilized by the applicant) shall file a preliminary environmental report. A preliminary environmental report need not be filed with the following applications unless the applicant has been required to provide notice of proposed construction under § 1.1311:

(1) Applications accompanied by the statement provided for in § 1.1313 or by the detailed environmental report provided for in § 1.1317.

(2) Applications for authority to mount an antenna on an existing antenna tower, provided the height of the structure is increased by no more than 20 feet or by no more than 10%, whichever is greater.

(3) Applications for authority to construct an antenna structure which will extend no more than 20 feet above ground or natural formation or above an existing man-made structure.

(4) Applications proposing to locate antenna structures within an established antenna farm.

(5) Applications which involve the attachment of additional wire or cable to existing telephone poles and do not involve the erection of new poles.

(6) Applications involving the installation of additional cable in duct or conduit space over existing cable routes.

(7) Applications for authority to modify existing facilities where the modification will involve no significant construction external to an existing structure.

(8) Applications for authority to construct an antenna structure which is to remain in place for a temporary period (as for the conduct of experimental operations or during the continuance of emergency conditions) and then be removed, provided there will be no lasting effects of environmental significance.

(9) Applications for authority to construct a temporary structure on an existing antenna site to maintain service pending repair of the permanent structure.

(10) Applications for authority to replace an existing antenna structure with a new structure on the same site having essentially the same height and design.

(11) Applications for authority to construct facilities to be utilized exclusively in rendering services to the United States Government, where the existence or purpose of such facilities is classified security information. (In such cases, it would appear that the environmental determination should be made by the Government agency for which the services are to be rendered under procedures compatible with the national security and on the basis of information which that agency alone may have.)

(b) The purpose of the preliminary environmental report is to require the applicant, and to permit the Commission, to ascertain whether the construction proposed would involve a significant environmental problem. If the applicant concludes that the proposed construction will have a significant effect on the quality of the human environment, he should file a detailed, rather than a preliminary, environmental report. The preliminary report shall describe the construction site and the construction proposed, including auxilliary construction such as access roads and power lines. It may be set out as a narrative statement. The following questions are illustrate of those which should be answered in the report:

(1) *Harmony with man-made uses.* How far is the proposed construction from the nearest structures not owned or utilized by the applicant? What is the character of these structures (e.g., residential, business, industrial)? How is the area zoned? Was it necessary for the applicant to obtain a zoning variance? State your conclusion as to whether the proposed construction is in harmony with or would disturb man-made uses of the surrounding area. If there are elements of disharmony or disturbance, state why they are not considered of environmental significance.

(2) *Harmony with natural uses.* Does the proposed construction intrude in any significant way upon wilderness areas, wild-life preserves, natural flyways for birds, or like areas? Would construction require the significant destruction of vegetation required as food or shelter by animal life native to the area? If there is some intrusion upon natural uses, state why it is not considered to be environmentally significant.

(3) *Harmony with environmentally valuable sites.* Is the proposed construction so situated as to detract in any significant respect from the value of any scenic, cultural, historic or recreational site? If there is some intrusion on such a site, state why it is not considered to be environmentally significant.

(4) *Substantial change in the character of land utilized.* Does the proposed construction effect any substantial change in the character of the land utilized (e.g., deforestration, water diversion, wetland fill, or other extensive change of surface features)? If there is some substantial change in the character of the land utilized, state the reasons for concluding that the change is not environmentally significant.

(5) *Comments and complaints.* What efforts (if any) have been made to elicit comment on the environmental effect of the proposed construction? Submit copies of any written comments or complaints received.

§ 1317 *Applicant's detailed environmental report.*

A detailed environmental report shall be filed if it is determined by the applicant or by the Commission that the proposed construction will have a significant effect on the quality of the human environment or if there is reason for substantial doubt as to the proper conclusion. The detailed report, like the preliminary report, shall describe the environmental impact of the proposed construction and shall, in addition, deal with such of the following matters as may be pertinent:

(a) *Any adverse environmental problems which cannot be avoided should the proposal be implemented.* (1) What steps have been taken or will be taken to reduce, minimize, or eliminate any adverse environmental impact? These could include reforestation, landscaping, architectural innovations, sewage treatment facilities or arrangements, fences to limit access to dangerous areas.

(2) Assuming such steps are taken, what significant environmental problems remain which cannot be avoided?

(3) Why can they not be avoided?

(b) *Alternatives to the proposed action.* (1) What alternatives have been considered which could reduce, minimize or eliminate any adverse environmental impact? These could include relocation of the construction site, location of an antenna or an existing structure rather than on a new tower, self-supporting rather than guyed antenna towers, and so forth. Where receiving equipment is subject to control by the applicant, consideration could also be given to use of higher capability receivers with a shorter transmitting antenna tower.

(2) What environmentally desirable alternatives exist that have not been adopted?

(3) Why have they not been adopted?

(c) *The cumulative long-term effect of the proposed construction, to the extent it differs from the immediate effect of the project considered in isolation.*

(d) Any irreversible and irretrievable commitment of resources which would be involved in the proposed construction. This provision relates to the depletion of limited natural resources, which is a factor we would not expect to be present in the construction of communications facilities, except possibly in limited respects

(see, e.g., § 1.1315(b)(2) and (4)). Nevertheless, the environmental report should deal with this factor, should it be present.

§ 1.1321 *Commission consideration of environmental effect.*

(a) The Commission will consider the environmental effect of proposed construction in all instances in which a preliminary or detailed environmental report is required.

(b) If the request is not accompanied by a detailed environmental report, and if it is clear from the preliminary environmental report that the proposed construction will not have a significant effect on the quality of the human environment, the request will thereafter be processed without further consideration of environmental factors.

(c) In reviewing the preliminary environmental report, the Commission may require the submission of additional information or may direct the applicant to request (additional) comment and report the results to the Commission. Processing of the application will be deferred pending receipt of such additional information.

(d) If upon reviewing the preliminary environmental report the Commission concludes that the proposed construction will have a significant effect on the quality of the human environment, or if there is substantial doubt as to the proper conclusion, the Commission will direct the applicant to submit a detailed environmental report and will defer processing the application pending receipt of such report.

(e) In reviewing a detailed environmental report, the Commission may direct the applicant to consider additional measures or alternatives which could reduce, minimize or eliminate an environmental problem and which were not considered in the report. The Commission may direct that technical studies be made or that expert opinion be obtained regarding the effect of the proposed construction and regarding the environmental, communications and cost effects of additional measures or alternatives which could reduce, minimize, or eliminate an environmental problem.

(f) If a detailed environmental report is submitted with the application or subsequently filed pursuant to Commission direction, the Commission will publish in the Federal Register a public notice containing the following information:

(1) The nature and location of the construction proposed.

(2) Whether there has been opposition to the application on the basis of environmental considerations.

(3) A brief statement regarding the nature of any environmental problem dealt with in the detailed environmental report or raised in any opposition to the application.

(4) A statement that the application and the environmental report and any oppositions are available for inspection at the Commission and in the local community or, if construction is not localized, at other appropriate locations.

(5) A statement that comments or petitions to deny the application on the basis of environmental considerations may be filed within 30 days after publication.

(g) Action on the application will be deferred for 30 days following publication of the notice in the Federal Register. Comments or petitions to deny the application on the basis of environmental considerations shall be filed within this 30 day period. If a person who comments or petitions to deny is specially qualified in any way to comment on environmental considerations, a statement of his qualifications shall be set out in the petition. Comments and petitions to deny shall be served on the applicant. The petition to deny shall contain specific allegations of fact sufficient to show that the petitioner is a party in interest and that grant of the application would be prima facie inconsistent with the public interest. Such allegations of fact shall, except for those of which official notice may be taken, be supported by affidavit of a person or persons with personal knowledge thereof.

(h) Provisions for public notice and petitions to deny on the basis of environmental considerations shall apply whenever a detailed environmental report is filed, regardless of whether the request would have been subject to notice and petition to deny procedures on other grounds. However, provision for notice and petition to deny on the basis of environmental considerations shall not open the application to attack on other grounds. Where a public notice is required for environmental and other reasons, a single notice may be published.

(i) Where public notice is published in the Federal Register, copies of the application, the detailed environmental report, and all related materials will be forwarded to the Council on Environmental Quality, to other Federal agencies having jurisdiction of special expertise with respect to the environmental impact of the proposed construction, and to appropriate State and local agencies, with a request for comment on the environmental impact of the construction proposed. The applicant may be required to file such number of additional copies of the application and related papers as are required for this purpose. Thirty (30) days will be allowed for comment. The identity and qualifications of the person(s) who prepared the comments shall be specified therein. A copy of agency comments shall be served on the applicant by the commenting agency.

(j) The applicant may respond to petitions to deny and agency comments within 21 days after the time for filing such petitions and comments has expired. The response shall be served by the applicant on persons who filed petitions to deny and on agencies which filed comments. The response shall contain specific allegations of fact or denials thereof, which shall, except for those of which official notice may be taken, be supported by affidavit of a person or persons with personal knowledge thereof.

(k) The application, the detailed environmental report, and all related papers, including agency comments, shall be routinely available for public inspection.

(l) The applicant shall maintain a copy of the application, the detailed environmental report and related papers in the local community and make them available for inspection upon request. If construction is not localized, these materials shall be made available for inspection at such location(s) as may be appropriate to provide reasonable access to persons affected by the proposed construction.

§ 1.1323 *Commission action following the submission of comment on environmental effect; detailed environmental statement.*

(a) Following completion of procedures designed to elicit information and comment regarding the environmental effect of the proposed construction, and upon consideration of all information submitted, the Commission will make a determination as to whether such construction will have a significant effect on the quality of the human environment.

(b) If it is determined that the construction will not have a significant effect on the environment, the application will thereafter be processed without further consideration of environmental factors.

(c) If it is determined that the construction will have a significant effect on the environment, the Commission will prepare a detailed environmental statement. The statement will indicate the nature, location, and environmental impact of the proposed construction and will deal with such of the following matters as may be pertinent:

(1) Measures which will or could be taken to reduce, minimize or eliminate any adverse environmental impact.

(2) Alternatives to the proposed construction which could reduce, minimize or eliminate any adverse environmental impact.

(3) The cumulative, long-term effect of the proposed construction, to the extent it differs from the immediate effect of the project considered in isolation.

(4) Any irreversible and irretrievable commitment of resources which would be involved in the proposed construction.

The detailed environmental report may be incorporated by the Commission into its detailed environmental statement. The statement, shall, in addition, however, take into consideration all matters of substance raised by persons or agencies objecting to the construction on the basis of environmental considerations and shall contain an independent statement of the Commission's conclusions.

(d) The detailed environmental statement will be associated with the application and will be routinely available for public inspection. Copies of the statement will be forwarded to the Council on Environmental Quality and to individuals who filed petitions to deny and agencies which filed comments. Action will not be taken less than 30 days after issuance of the detailed statement.

(e) If on review of the detailed environmental statement the Commission finds that there is no substantial and material question of fact relating to environmental considerations and that the public interest will be served by granting the application, it will grant the application.

(f) If on review of the detailed environmental statement it appears that there is a substantial and material question of fact relating to environmental considerations or that the Commission is unable, on the basis of environmental considerations, to determine that a grant of the requested authorization will serve the public interest, convenience and necessity, it will designate the application for hearing on an environmental issue.

(g) If on review of the detailed environmental statement the Commission finds that there is no substantial and material question of fact relating to environmental considerations but that a hearing is required for other reasons, it will designate the application for hearing on non-environmental issues only.

(h) Regardless of the action take, the Commission will issue a statement of the reasons for its action.

§ 1.1325 *Consideration of the detailed environmental statement during the hearing and decision-making process.*

(a) If a case is designated for hearing on an environmental issue, the detailed environmental statement will be attached to the designation order and will be considered in delineating the scope of the environmental issue.

(b) Copies of comments from Federal, State and local agencies will be associated with the record of the hearing proceeding, shall be admissible in evidence for the limited purpose of showing the views of those agencies, and may be used in cross-examining witnesses on the environmental issue.

(c) Agencies and individuals who comment on environmental effect may be invited to participate as parties to the proceeding and, if not named as parties, may petition to intervene. Agencies which comment may be asked by Commission counsel or others to furnish expert witnesses to testify on matters of environmental impact. Subpoenas for the appearance of such agency experts will be issued, if necessary, when their testimony is required to lay a foundation for the admission of agency comments in evidence to show the truth of facts and the validity of conclusions contained thereof.

(d) The burden of proceeding with the introduction of evidence on the environmental issue, as well as the burden of proof on that issue, shall be upon the applicant, except as otherwise provided in the designation order.

PETITIONS: DELAY the DOCKET! REPEATER RESPONSIBILITY

4 October 1972

PETITION: To delay amendment of the Commission regulations (Docket 18803) for a period of one year to give repeater groups sufficient time to meet the drastic changes which the new regulations demand.

The October 17th deadline for amendment of the rules is wholly unrealistic since the new rules require substantial changes for most of the active repeater stations now in the amateur services.

It will take considerable time for the nearly one thousand repeater groups and clubs to understand the requirements of the new regulations, assess the changes that will be required to conform to them, raise the money necessary to buy the equipment or parts needed for the new control link functions, build and test the new circuits and links, and get everything working.

In addition to this there is the matter of developing the information needed for applying for the new repeater, control and link licenses, which could be formidable for people who are working in their leisure time without renumeration.

Unless the Commission delays the adoption of this amendment it would work a serious hardship on most of the repeater groups.

At a recent meeting of twenty-nine repeater groups in Waltham the vote was unanimous to request the Commission to delay adoption of the new regulations. The entire group felt that the difficulties and problems posed by the new regulations were so severe that the old regulations were preferable, even though this meant the loss of the 147 MHz segment to Technicians.

Wayne Green W2NDS/1

PETITION: To amend the regulations for amateur repeater stations to the effect that control operators are responsible for the technical operation of the repeater, not the content of emissions. The responsibility for content would fall entirely upon the originating operator.

The Commission regulations for controlling amateur repeater stations would seem to encompass two separate functions – the technical maintenance of the repeater and a censorship role over users of the repeater.

In view of the almost total ambiguity from the Supreme Court right on down to the lowest courts as to what can or cannot be broadcast or published, what is obscene or profane, etc., it is obvious that no amateur is properly equipped to undertake this function. The Commission provides no clear guidelines for amateurs embarking on this censorhsip role. Amateurs who watch Commission licensed television stations and listen to Commission licensed broadcast stations would be hard put to make any reasonable decision as to what is or is not profane or obscene.

Perhaps the control operator should follow the Supreme Court rulings and listen at length to transmissions made through the repeater to decide whether there is redeeming social merit in the matter.

The primary responsibility for emissions would seem to rest with the operator originating the emissions. A control operator cannot shut off a repeater quickly enough to prevent some profane transmissions. Let's assume that the word "fuck" is judged to be profane – or at least objectionable. It only takes a few milliseconds to send this word through a repeater. A diligent amateur with some psychological problems (and there are some) can break in with a quick "fuck" every few minutes and present an insoluable problem to the control operator. If he is really into the project he can automate with a tape recorder and clock so he won't have to wear himself out in the process. The short breaks make direction finding difficult. Just what is the responsibility of the control operator when faced with this sort of thing – and where does it end?

There seems little reason why one person with problems should be able to effectively shut down a repeater. The simple change in the regulations requested would solve this difficulty.

It is possible that amateurs might feel more secure in their role of censor, should the Commission decide that this should be continued, if they had an official Commission list of words or phrases that are considered profane or obscene. It would make it much easier as the control operators sat there on their long nightly vigils, monitoring each and every transmission going through the repeater if they had such a list. Such a list, if provided, will be published and circulated to repeater control operators.

The ability to force a repeater off the air with obscenities is a powerful weapon in the hands of an amateur with psychological problems. Until the Commission adds a psychiatric exam to the amateur license exam there will inevitably be a few people with serious mental problems who manage to get a ham license. The ability to learn code is no measure of sanity – to the contrary, according to some psychological circles.

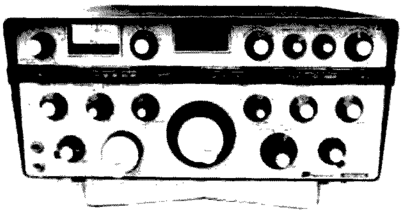
If repeaters were able to stay on the air it would not be difficult for repeater groups to locate profanity problems. The Commission has recently given special permission for repeaters to stay on during jamming problems to help in locating the offending parties. If repeater control operators were responsible for the technical operation of the repeater and not for censoring it, these annoyances could be dealt with forthwith.

The Commission would consider that the listeners to a repeater are generally few in number, particularly in comparison to a braodcast or television station, and that the listeners are generally reasonable mature (in age) persons. Thus there is a small liklihood that profanity would cause any serious and irreperable harm. Since the Presidential Commission report on obscenity was unable to discover any damaging effect from even the vilest pornography, the probability that profanity on amateur radio would have a lasting effect is small.

It is therefore requested that the Commission amend the amateur regulations to place the responsibility for emissions on the operator originating them and not on the control operator of a repeater which might repeat them.

Wayne Green W2NSD/1

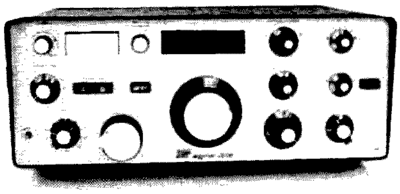
With Signal/One's CX7-A you settled for the best.

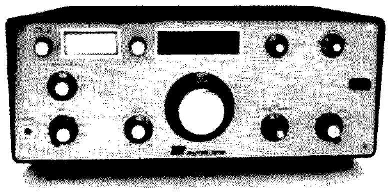


Now meet the rest of the best.

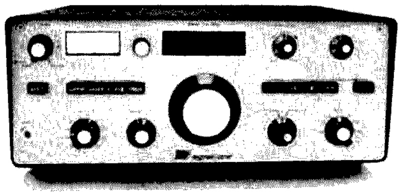
A few short years ago, Signal/One introduced the solid-state CX7-A. It was quickly recognized as the world's most advanced radio transceiver. It still is. Now, Signal/One is more than just the CX7-A. A lot more.

For openers, we've added two new receivers. One, the CR-1500, a dual-channel system is so advanced — in selectivity, sensitivity and versatility — you won't find anything like it this side of a research laboratory. The CR-1200 receiver, our other new one, features a single VFO. If it weren't for its bigger brother, it would be the finest receiver you could buy.



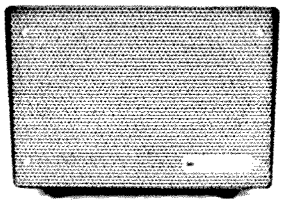


There's a new CT-1500 transmitter, the matching transmitter for use with the CR-1200 and CR-1500 receivers. It incorporates all modes of operation and includes the famous Signal/One RF envelope clipping, broadband tuning, full-automatic CW keying, and many other features.



We're also introducing a new transceiver, the CX-10, which contains several CX7-A features. In addition, it can be used with either our new AC or DC power supplies, an external VFO, and other accessories.

Our new accessories include a deluxe station console, speakers, 2-meter and 6-meter transverters with direct digital readout and FM capability, and custom microphones.



In the past years, there were one or two names in amateur radio gear that meant the finest. In their time they were.

Times have changed. Now, if you want the finest, choosing is easy. It's all at Signal/One.

13130 Yukon, Hawthorne, Ca. 90250 (213) 679-9022 signal/one

Loring C. White W1ODI
26 Boswell Road
Reading MA 01867

HANDIE-TALKIE TOUCH TONE

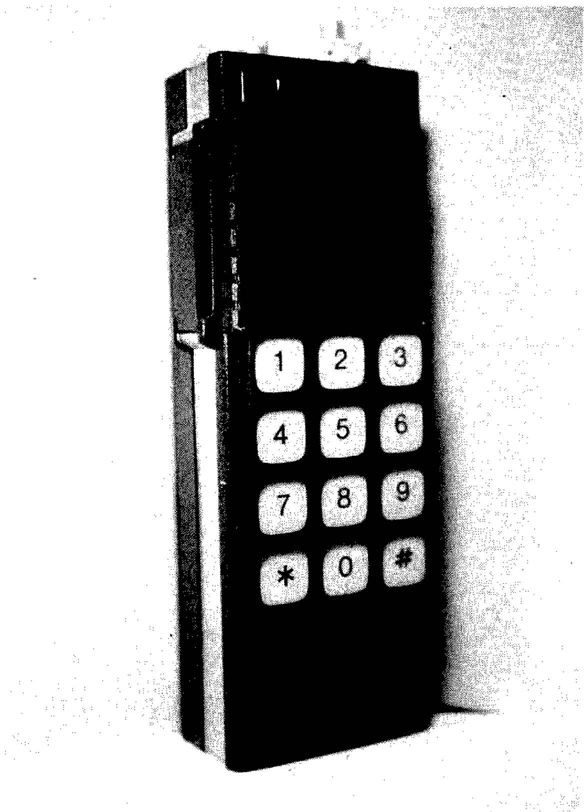
Make phone calls through the local repeater while walking down the street with this modified HT-220.

For those of you who might like to make phone calls from your back yard or who would like to make up a "phone in the shoe" system a la the "Get Smart" TV program, here is a way to do it!

If you happen to find a Motorola HT-220 2 meter handie talkie (which, incidentally, is smaller than my shoe size) in the shack junkbox, you are a long way to realizing your own wireless touch tone system. You will need the following additional items:

1. Touch pad Chomerics #EF-20071, $7.95
2. Tone generator – hybrid chip – Microsystems International Canada #ME-8900 CA., $25.00
3. 5 μF capacitor
4. 700Ω resistor
5. 40 KΩ resistor
6. 10,000Ω micro potentiometer
7. Plexiglas shim plate 3 x 2.25 x 1/8 in.

Looking at the photo you will see that the "pad" is mounted just below the speaker grill. It is necessary to insert the plexiglas shim plate between the HT-220 case and the pad in order to take up space from the connecting pins on the back of the pad. So that the pad and spacer will lie flat against the front cover, it will be necessary to file the rounded surface of the cover flat, just under the pad. The file work is about the toughest part of the whole job, but is very important to prevent warping of the thin pad.



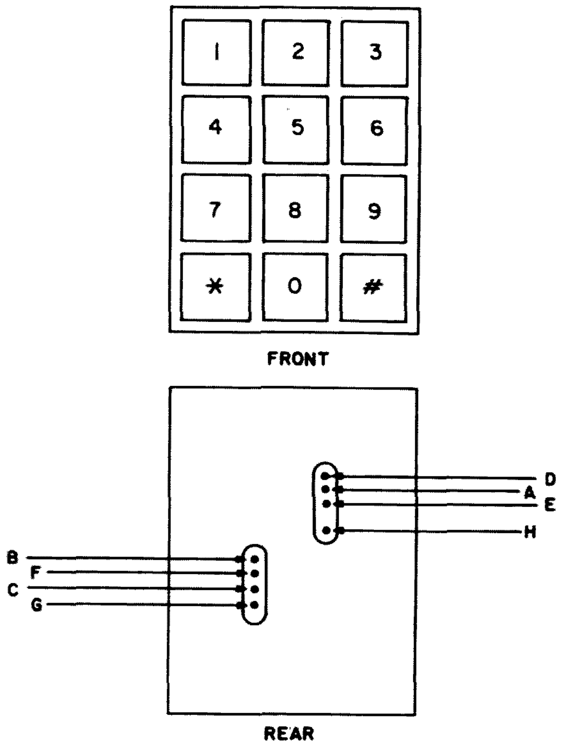


Fig. 1. Front and rear view of the touch pad and its connections.

It will be necessary to drill two small slots through the HT-220 front to accommodate the eight miniature pins on the back of the pad. Remove and disconnect the HT-220 front cover and carefully locate the two pin areas free of the internal battery connecting strips. The pad may be conveniently attached to the cover using contact cement. It may be advisable to hook up the pad first to determine if everything is operating okay.

The hybrid chip may be counted just above the "PL Tone" compartment in the "thick case" model and the additional components cemented to the chip case, between the pins.

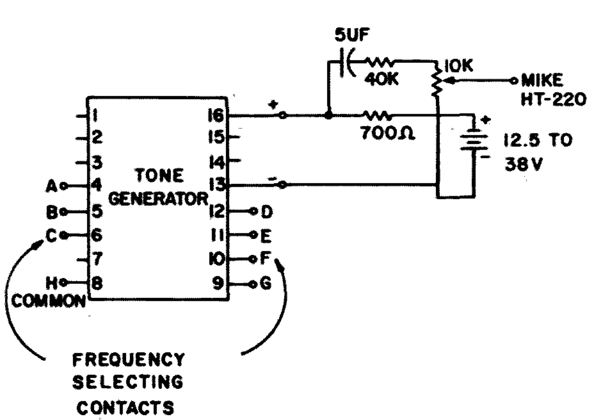


Fig. 2. Schematic showing connections between touch pad and tone generator.

Keeping the wires as short as possible, interconnect the pad and chip as follows:

Chip Pin	Pad Pin
4	A
5	B
6	C
8	H
9	G
10	F
11	E
12	D
13	Neg. 15V battery
16	Through 700Ω to pos. 15V battery
1,2,3,14,15	N.C.

I found that some rf problems disappeared after bypassing a few of the chip contacts with .001 μF ceramic capacitors to the negative battery terminal.

The degree of bypassing required will be determined by the application, antenna matching, etc.

Be sure to take the positive battery connection from a point on the HT-220 transmitter board so that the pad will be "on" only during transmitting periods.

The system is quite compatible with the Bell Tone System even though the output tones are considered to be pure sine wave as compared to the tones coming from the regular Western Electric pads.

Adjustment of the tone output level is most conveniently done by observing the transmitter output on an oscilloscope.

Adjust the 10,000Ω potentiometer for proper FM deviation level in accordance with the autopatch requirements of your favorite repeater.

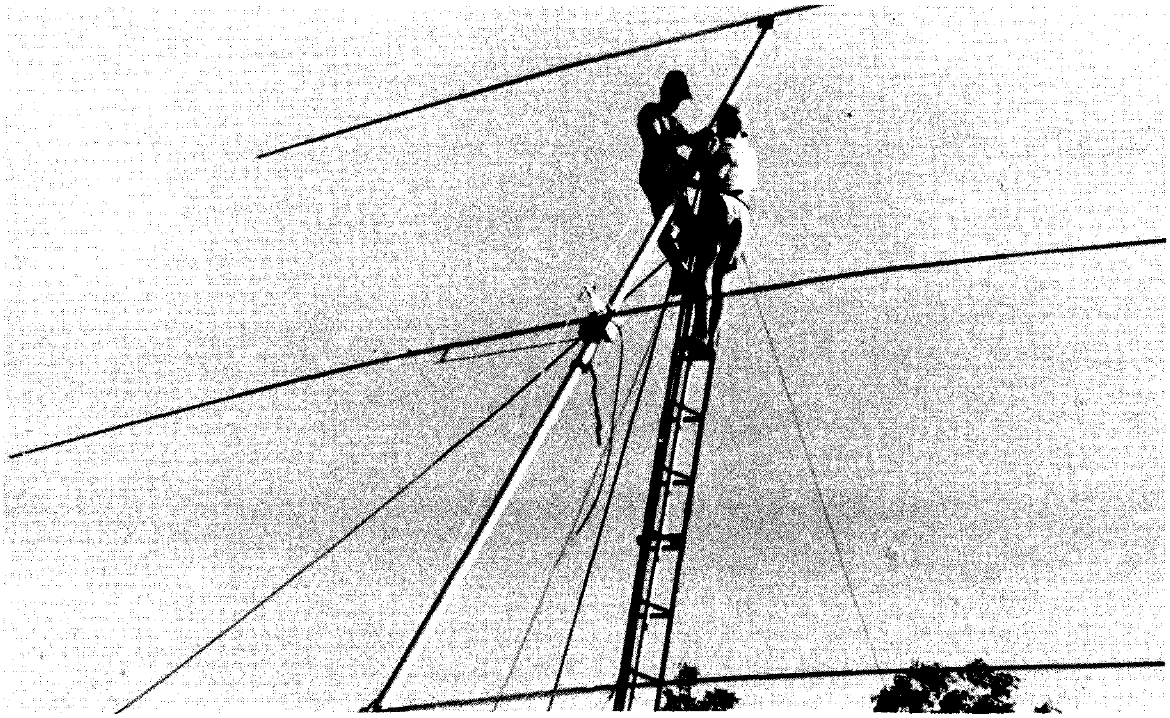
We have made several phone calls with the handie-talkie touch tone system over the Weston repeater, WA1KHB, and fired up the "Sanford link" through K1MNS from a location 15 miles north of Boston, Massachusetts.

A completely assembled 12-button pad with tone generator and all parts is available for $30.80 from Tom McKeever W1WJR, 28 Leigh Road, Norwell MA 02061. He also has quantities of 16-button pads for $35.12. Please add $1.20 for postage and handling.

...W1ODI

HOW TO WIN IN THE PILEUPS

Chet Latawiec VE3CFK
569 Carlton Street
St. Catharines, Ontario



There is an XT2 sitting on the band and everybody you can think of is calling him, trying to beat the other fellow out. So you get in and try your luck with your kilowatt and your dipole. If you're lucky, you might work him – that is, if you live a couple of miles away from the chap. If not, there is no conceivable way you can work the fellow within the next couple of hours.

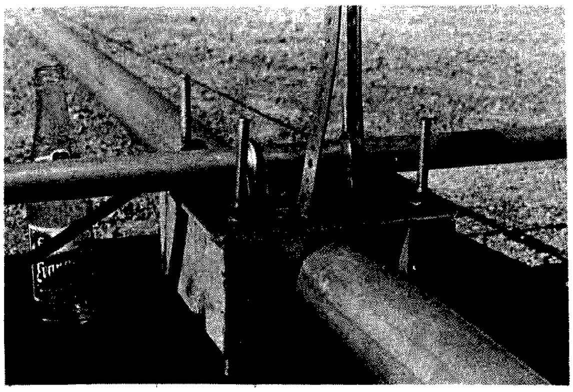
So get away from the ordinary and build yourself a three-element, wide-spaced beam and be the first to work that rare DX. I guarantee that with this type of antenna you can beat out any three-element triband beam and even some of the short-boom four-element beams.

This three-element, widespaced beam is plenty sturdy; it is of all-aluminum construction and so far has withstood winds up to 80 mph and a few Canadian ice storms.

If you intend to build this beam, *do not* alter any of the physical dimensions, as this will decrease the efficiency of the antenna. The frequency of the array was set in the middle of the band to allow its use on the CW and phone portions of 20m.

The elements are constructed of thin-wall aluminum tubing, of the diameter and length stated in Table I.

Each element is constructed of seven pieces. The center portion is 1 in. inside-



The view of the antenna element and its mounting.

diameter aluminum conduit to give strength to the remaining portions of the elements. The conduit is slotted at each end on both sides for about 3 in.

The remaining portions are fitted together to the values shown in Table II. About 4 in. from each individual piece of tubing is placed a self-tapping screw to insure that the elements do not move or rattle. At the end of each element is placed a drip hole about 1 in. from the end and a cork is press-fit in the end of the tubing to prevent the elements from whistling in the wind.

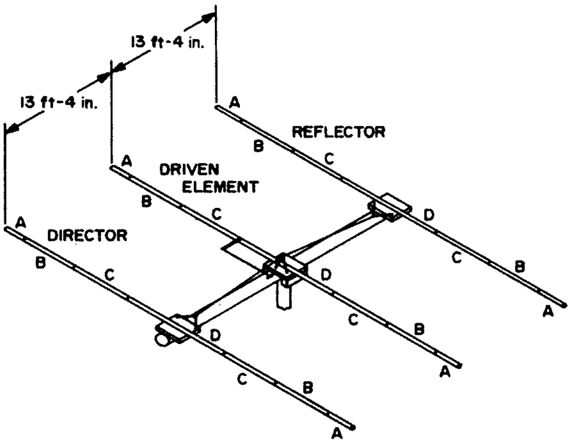
All three elements are constructed in the same manner, the only difference being their physical lengths. To obtain the proper length on each side of the center of the boom, the thin-wall aluminum portions of the elements are adjusted in or out of the aluminum conduit. Once the proper distance has been attained, drill a hole about 8 in. from the edge of the conduit and drop a self-tapping screw in, and also place a hose clamp about 1 in. from the end of the conduit.

Just a small note here on cutting the thin-wall aluminum. Most of the tubing comes in 12 ft lengths, so on the antenna portion cut the tubing in half and to obtain the proper lengths for the director and reflector for their overlap cut the tubing 6 in. off center.

The boom is a 27 ft 4 in. piece of 3 in. aluminum irrigation tubing. It is the most expensive single portion of the antenna, but is well worth the money spent, from at least the standpoints of the strength it gives and its light weight.

At each end of the boom there is a circular block of wood, the diameter of the pipe, which is fitted in the end of the pipe and then nailed. This precaution is necessary unless you are a bird lover.

The main feature of this antenna is the method used to mount the elements to the boom and keep them there. Aluminum plates (0.25 in. thick) are used in this deal. The plate is held to the boom by two 3 in. muffler clamps. The plate in turn holds the element with two smaller muffler clamps as shown in Fig. 2. The plate is first mounted



ELEMENT LENGTHS
REFLECTOR 35 ft-5 in.
DRIVEN EL. 33 ft-5 in.
DIRECTOR 31 ft-3 in.

ALL MOUNTING PLATES ARE 8 in. x 8 in. SQUARE

ELEMENT SECTION	ELEMENT DIRECTOR	DRIVEN EL.	REFLECTOR	TUBING DIAMETER
A	2 ft	2 ft	2 ft	3/4 in. OD.
B	5-1/2 ft	6 ft	6-1/2 ft	7/8 in. O.D.
C	5-1/2 ft	6 ft	6-1/2 ft	1 in. O.D.
D	10 ft AL. CON.	10 ft AL. CON.	10 ft AL. CON.	1 in. I.D.

TABLE I – THIN WALL LENGTHS

ELEMENT SECTION	DIRECTOR	DRIVEN EL.	REFLECTOR
A	1 ft–3 in.	1 ft–3 in.	1 ft–3 in.
B	4 ft–9 in.	5 ft–3 in.	5 ft–9 in.
C	4 ft–9 in.	5 ft–3 in.	5 ft–9 in.
D	10 ft	10 ft	10 ft

TABLE 2

THE VALUES GIVEN ARE FROM THE EDGE OF ONE PIECE TO THE EDGE OF THE OTHER.

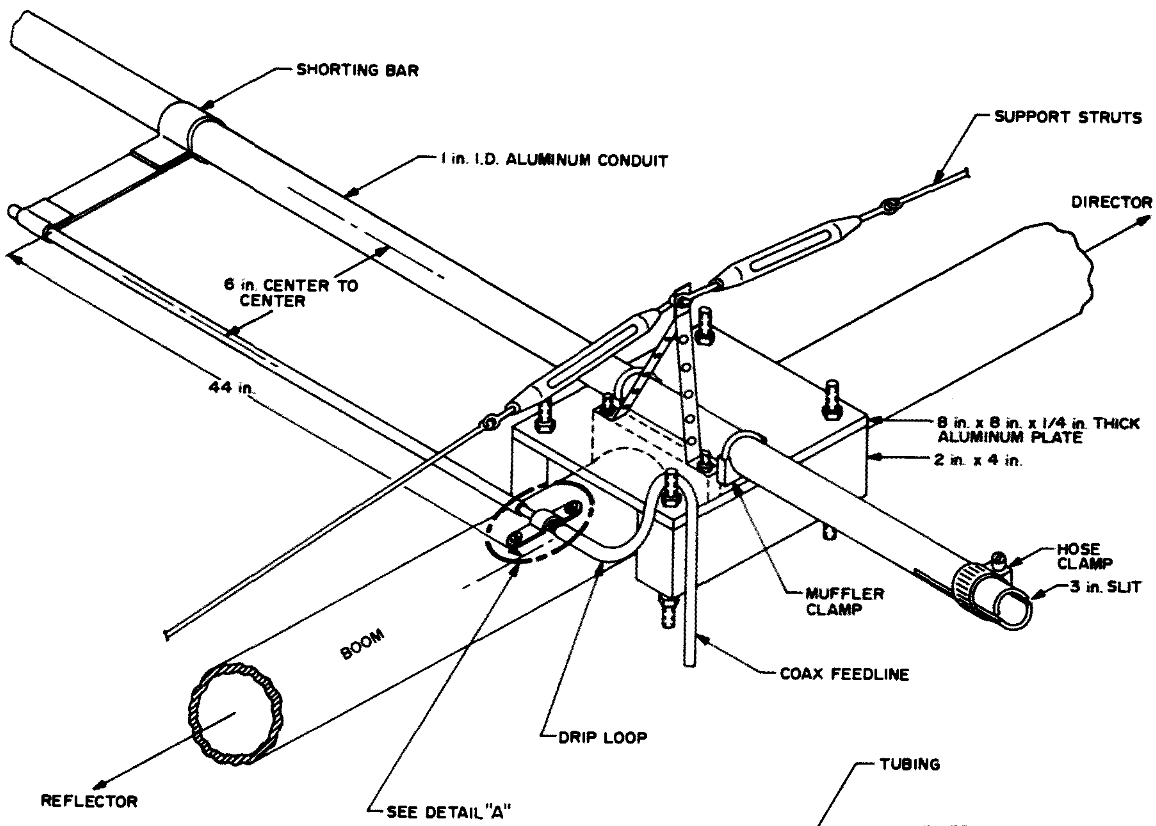
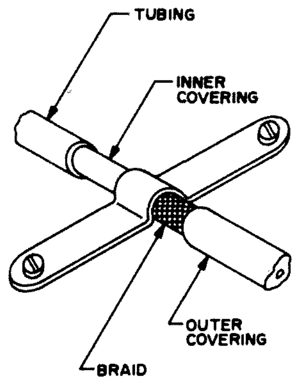


Fig. 2. This sketch shows the construction of the center plate of the beam and also the position of the gamma match. The diagram should be self-explanatory.



DETAIL "A"

on the boom with the 3 in. clamps and tightened slightly. It should be mentioned that all hardware used was galvanized heavily and then lead plate was used on all the nuts and bolts to prevent seizing and rusting.

The aluminum conduit portion of the elements is mounted and tightened on each plate. There are two pieces of grappling iron, about 6 in. long, which are placed on each side of the boom, one each under the nuts which are the furthest away from the ends of the boom. Make sure that the distance from the center of one parasitic element to the other is 26 ft 8 in.

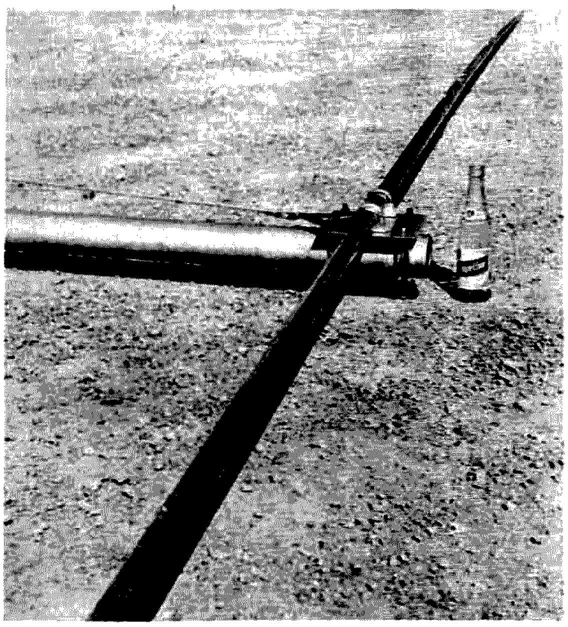
The center plate is a two-fold job. Two pieces of 2 x 4 are cut to length of the plate and long bolts about 7 in. are placed through the plate and boards and slightly tightened.

This plate is mounted to the boom as the other two were, using muffler clamps again. Then the conduit is mounted and clamped in its place. By sighting at the end of the boom, look at the three pieces of conduit and make sure that all three are parallel to each other, then tighten all the muffler clamps.

Now the remaining portions of the elements are placed in their respective places and finally the hose clamps are installed and tightened. When you do this make sure that the drain holes are on the bottom facing the ground.

Matching

On this particular antenna, a gamma match was tried and when adjusted properly, proved to be a very wise choice because the swr was flat across the band and did not exceed 1.2:1. It was con-



The view of the end element and its mounting.

structed out of a TV antenna element. The shorting bar was constructed from aluminum and was made so that the center of the aluminum conduit to the center of the 48 in. piece of TV element was 6 in. This is very important. The capacitor was made out of a length of RG-8, 41 in. of the outer covering was taken off and then 40 in. of the copper shield had the same treatment. On the remaining 1 in. of braid, there was soldered a brass or copper bracket which will later be used to mount it to the beam. The remaining portion of the stripped end of the coax was placed inside of the gamma tubing.

The bracket must be mounted onto the boom and it must keep the 6 in. from center to center constant.

The bracket is held in place by two self-tapping screws placed on either side of the hump in the bracket. At the other end of the coax a coaxial connector was placed to provide easy connection to the feedline. The inside of the shorting bar is 44 in. from the center of the boom.

Installation

The beam is installed on the mast by means of another plate. This plate is made of ¼ in. steel and is drilled to accommodate the four long bolts which are on the center plate of the beam. This plate is welded onto the mast to provide for a good slip-free connection.

The antenna is lifted onto the steel plate and the bolts placed in the hole. The nuts and lockwashers are placed on it and all mounting hardware is tightened.

Adjustment

There need not be any adjustments necessary to the elements if precautions were taken in acquiring the proper sized tubing and the measurements followed to the inch.

There may be, however, some adjustment needed on the gamma match. The values that were given in the above were used on three previous antennas identical to this one and no adjustment was needed. However, should the need arise that it does need attention, then the bracket on the gamma match must be taken off and the end of the coax trimmed, about half to a whole inch until the swr is down to at least 1.5:1.

Performance

With a beam like this you should not have any trouble working that XT2. You could even work 200 countries with a 100W, thus eliminating the need for a big kilowatt. This beam can outperform any antenna in its class.

Specifications

Gain	8.5 dB over a dipole
FBR	25–30 dB
Side Att	50 dB
Boom	27 ft 4 in. x 3 in.
Turning Radius	22.5 ft
Weight	45 lb
Cost	$80

Acknowledgements

Thanks goes to Howard Cowling (VE3WT), whose plans and ideas were presented in this article and also for the help he gave me in preparing and presenting it. Thanks also goes to Berny Goldchuck (VE3FYG), who took the pictures.

. . .VE3CFK

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IN THE HALLS OF THE GIANT... THE YAESU ESTABLISHMENT

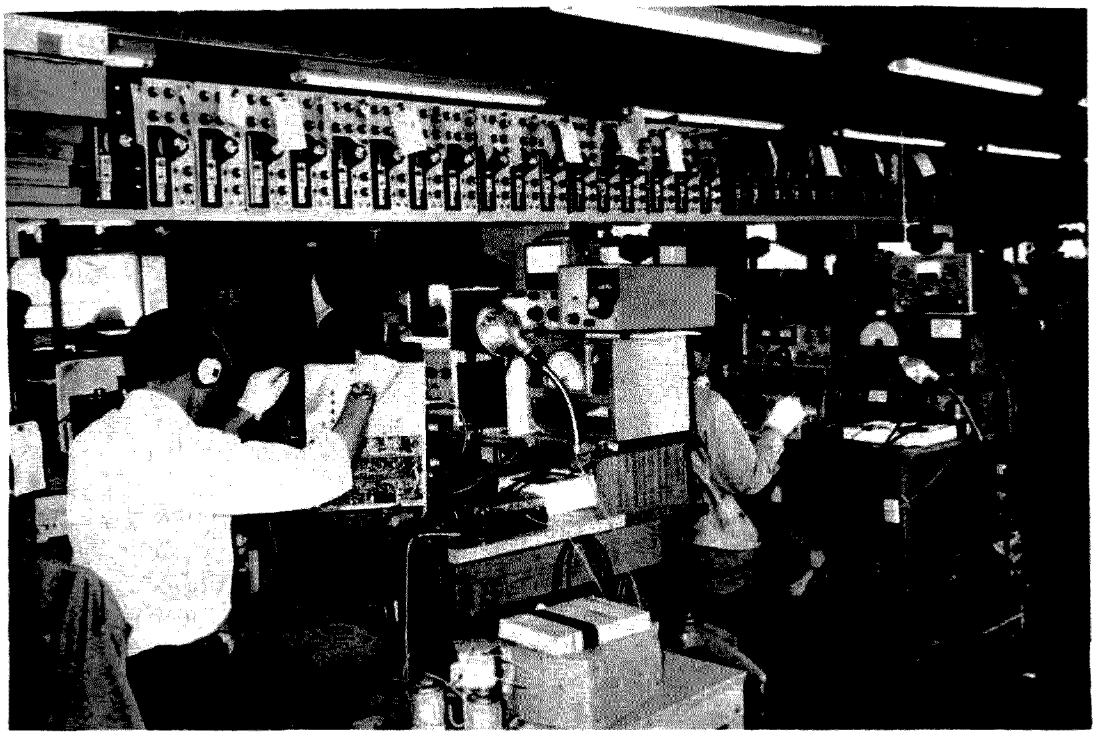
A phenomenon of the last five years in the amateur market has been the emergency of Japanese manufactured rigs of high quality, innovative design, and highly competitive pricing. The leader of this pack has been the Yaesu Musen Co., Ltd., which probably sells more HF SSB transceivers than all the rest of the world manufacturers put together. Certainly then a visit to the lair of this giant would be a highlight for a ham visiting Japan. This is a record of my too brief visit with some tips for those of you who have the opportunity to pass through Tokyo in the future.

After concluding my busines in Tokyo, we had a free afternoon before plane time. A call indicated the Yaesu plant, somewhere out in the wilds of south Tokyo, would be happy to see us. Another phone call to the plant by a most helpful lady at our hotel information desk elicited the information that the plant was about a 40-minute taxi ride, and generally in the direction of the airport, but finding the place was a little difficult even for Tokyo. For five solid minutes she took down instructions in Japanese characters and then copied them neatly for the taxi driver – a must for even the simplest jaunt in this world's largest metropolis.

We piled into a taxi selected for us by the doorman, and the driver placed the precious sheet of instructions for quick reference. We shot off on one of the expressways, ran it to its end, then continued for miles on surface streets, finally narrowing down into some lanes. The highlight of this little journey for me was the many tantalizing glimpses into the gardens of private homes, each different but immaculate in design and appearance in the Japanese fashion. Thirty-five minutes or so brought us into the area where the driver started looking at me questioningly as I shrugged my shoulders. A couple of circles and obviously conflicting directions from people on the street suggested we were not making headway. At a phone booth, I put the driver on the phone to the plant for further orientation. Soon we had a 3 element yagi in sight and after one more circle we arrived at an unassuming three-story building.

Mr. Shigeru Takagi, KH3NUD, Sales Manager, met us and said this was really not now a manufacturing plant but rather the final inspection facility. One factory is west of Tokyo and the main manufacturing facility is north of Tokyo, in Fukushima. Three assembly lines are in operation at that plant and a new plant is under construction. Shigeru told me that there were forty FT-101's being turned out every day and almost forty of the FT-401/560-570 series. Add to this the several linears, the FT-200's (very popular in Japan), and the growing two meter line – Yaesu must have the lion's share of the amateur market. Their own estimate, admittedly not exact, is 80% outside the U.S. and perhaps 20–25% in the U.S.

Time was short, so up the stairs we went to meet Kim, JA1KRZ, in charge of the inspection facility. In a room about 40 x 100 feet about 25 technicians worked, each at an individual well-equiped test bench. Along one wall, literally stacked like hot



Just look at all those transceivers getting a final checkout before packaging. Recognize yours? (Photo courtesy YAESU)

cakes (which I guess they are selling like), were rows of the FT-2B and FT-2 Auto 2 meter transceivers. Kim showed us how the auto-scan feature worked on the FT-2. It was fascinating to watch the blinking red lights scan for an active channel. It was surprising how much 2 meter action existed, particularly when I learned that this was all direct. Repeaters are not yet legal in Japan, but the VHF boys are hoping this will be changed. That should be a boom to watch – can you imagine a country with a growing amateur population nearly that of the U.S., complete with a large, enthusiastic VHF contingent, suddenly being allowed to establish repeaters? The mind boggles.

The 2 meter gear intrigued us but it was equally impressive to see all the HF gear being given final testing and alignment. I noticed, by the way, that most of the test benches included Yaesu's own frequency counter. Shigeru told us that there were at least 100 hams employed by Yaesu. Yaesu must be the largest single employer of radio amateurs in the world.

All too soon lights were starting to go out and people were starting to head for home Time for us to bid our "Sayonara" and depart. But, for the rest of you , here are some tips if you should have an opportunity to go to Japan. I might add many of the things I did *not* do, myself. If you know your plans ahead of time, by all means write ahead and let them know your itinerary and interests. Letters will reach Yaesu Musen Co., Ltd., at Central Post Office Box 1500, Tokyo. I would imagine that a letter to the JARL, Box 377, would produce some interesting results. Yaesu's main office is at 3, 3-Chome, Yaesu, Chuoh-Ku, Tokyo, Phones 271-7711 to 7716. The factory we visited is at 2-15, 1 Chome, Kugahara, Ota-Ku, Tokyo, Phones 753-6141 to 6145.

Another place worth a visit in Tokyo is the Akihabara district of Tokyo where hundreds of eleectronics supply stores are scattered over 5 or 6 square blocks. Four or five of these stores deal specifically in ham gear. But, regardless of where you go in Tokyo, the rule is to have the hotel write the address and instructions in Japanese and have the doorman make sure the taxi driver understands them.

In any event, you'll find that the innate politeness and hospitality of the Japanese will make your explorations delightful experiences. Sayonara.

. . .WB6IZF

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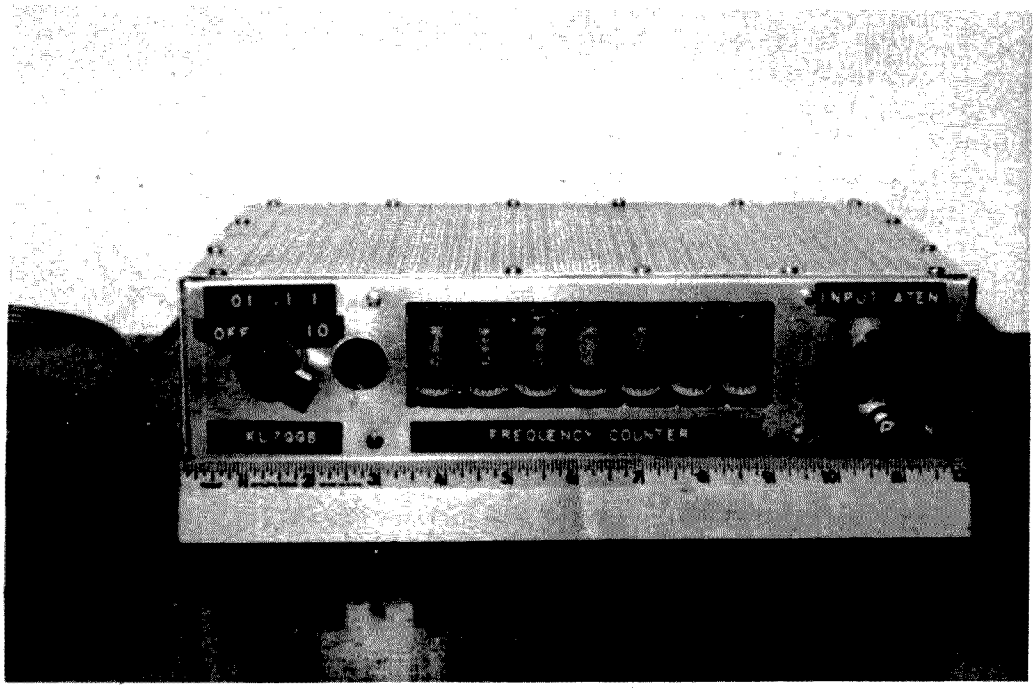
ANOTHER INTEGRATED CIRCUIT FREQUENCY COUNTER

This counter was constructed as a personal project to help me better understand the workings of integrated circuits and their operation. That's why I used RTLs together with TTLs. I also had them on hand so it was cheaper than buying new ones. All of the circuits used are standard with no exotic tuning or adjustments.

The only test equipment required is a VOM to check voltages and a scope to troubleshoot possible bad connections. To set the time base generator on frequency I



The 50 MHz frequency counter. Notice how the author included a metric rule in the photograph to indicate the unit's width of 30.48 cm.

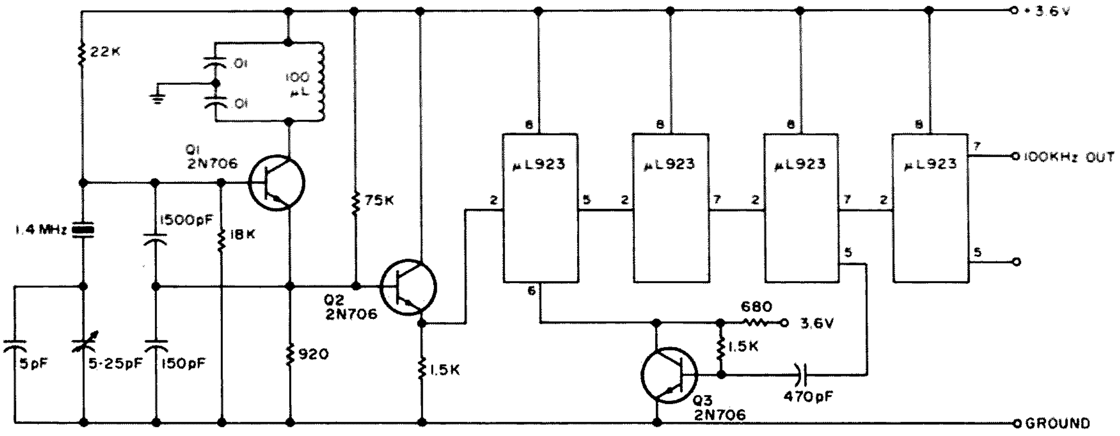


Fig. 1. Time base generator.

recommend comparison with a commercial counter or comparison with WWV using a scope to get as close as possible to the exact frequency. The common practice of zero beating by ear is just not accurate enough. This is especially true if you want the counter to have the best possible accuracy that this design will give. I calibrated a ten MHz crystal to WWV, then adjusted my counter to read 10.000.00+. That was the best method available with my limited resources.

Construction Ideas

The arrangement of the decade counting units (DCU) is straight in line with the SN74196 being first on the right as viewed from the front. The rest of the ICs were placed so as to keep the wiring as short as possible to minimize interference between sections. The main part of the counter was constructed on a 4 x 6" vector board with .1" center spaced holes which match the spacing of the ICs. No sockets were used although all ICs are removable. This was accomplished by using integrated circuit terminals. These terminals come in strips of 56 each. This is a convenient size as the whole strip can be inserted in the holes, wired and then the top of the strip is broken off giving the equivalent of sockets with less cost and effort. In my counter I use seven display tubes which fit well on the board and came out just right for the integrated circuit terminals. I use AKZ type tubes and sockets, they also fit the .1" spacing on the vector board. An etched circuit board would improve the looks, but that would not allow much flexibility in the development of the counter.

Input Amplifier

In the construction of the input amplifier I tried several types of integrated circuits before settling on the SN72733. Four 2N2369's were tried first and found to be unsatisfactory. The RCA CA3018 was then tried and found to be an excellent input when used with a 74H10 input gate, it will go up to 32 MHz with no problem. The SN72733 from Texas Instruments will work up to 50 MHz with the SN74S10 input gate. You have to use the combinations together, the SN72733 with the 74S10 for 50 MHz, the CA3018 with the SN74H10 for up to 32 MHz.

If you want lower frequency operation you can use the CA3018 with a SN7410 and by this route be able to use a SN7490 for

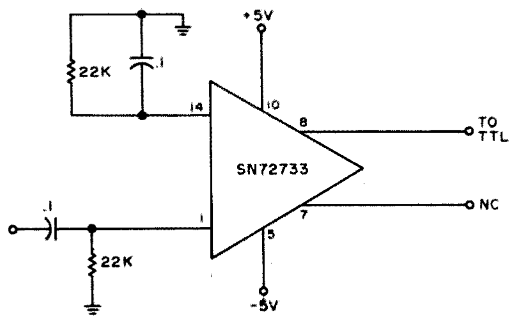


Fig. 2. Input amplifier circuit. Pins 3, 4, 11, 12, are open. Pins 2, 6, 9, 13 NC.

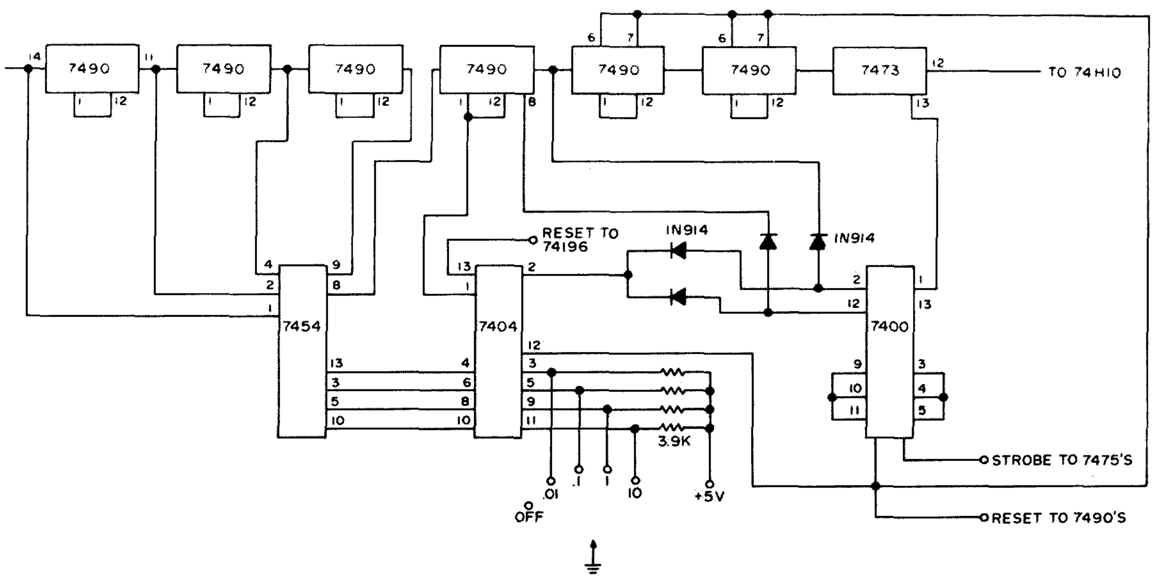


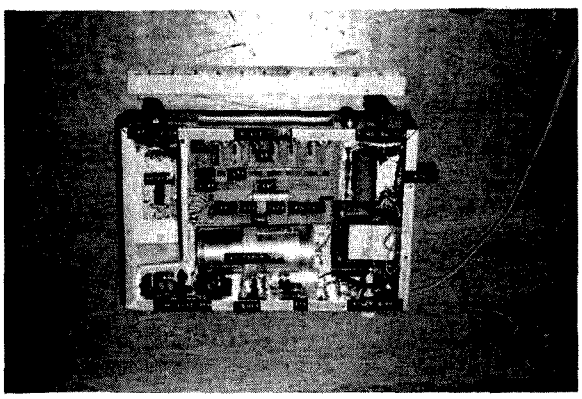
Fig. 3. Timing circuit.

the first DCU. This combination would be able to count to approximately 20 MHz. I wanted to go all out and count as high as possible, so I continued until I could get at least 50 MHz. This is the only section of the counter where different designs were tried. The rest of the counter was designed and constructed with very few changes being made. From the input gate the signal is fed into the first DCU. All of the DCU's are alike except the first one which uses a SN74196, SN7475 and SN7441 which gives the first digit. The rest of the DCU's are SN7490, SN7475 and SN7441. The SN74196 is used in the first DCU because it has a higher toggle rate (50 MHz) than the SN7490 which will only go to 20 MHz maximum. The SN74196 has to be reset through an inverter because it needs a negative going pulse to reset whereas the SN7490 needs a positive going pulse.

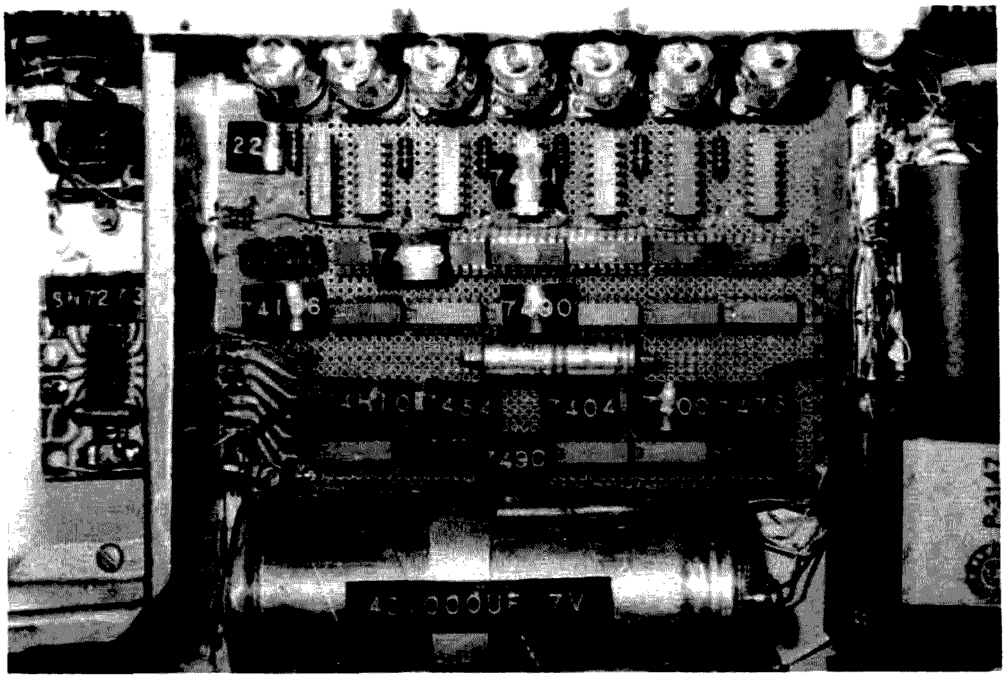
The input gate is opened and closed by the Q output from the JK flip-flop SN7473. The $\overline{Q}$ output is connected to the four wide two-input *nand* gate SN7400 together with pulses from decade scaler number four to generate the strobe and reset. The diodes are used to decouple the set up pulses passing current in one direction only. The SN7400 is blocked from producing the strobe and reset except when the gate is closed by the $\overline{Q}$ output from the JK flip-flop. When the strobe is generated the count is transferred to the read out, then the reset is generated resetting the DCU's and scalers five and six to be ready for the next sequence in counting. This is a good scheme and gives a good ratio of read out time to count time.

Time Base Oscillator

The time base oscillator uses a 1.4 MHz crystal in a circuit using a 2N706. The padder in series with the crystal allows calibration to the exact frequency. The buffer is also a 2N706 that serves to drive the first μL 923 in the divide by seven circuit. Pin 5 of the third μL 923 is connected to another 2N706 in a half monostable circuit resetting the first μL 923 forcing a divide by seven. The last μL 923 divides by two giving 100 kHz output. This can be modified to fit any crystal as long as



Top view of the counter. Note the shielded compartment that separates the input circuitry from the rest of the unit.



Close up of the main circuit board showing the IC layout and Nixie tube mounting.

it can be divided by a whole number. The whole divider chain can be eliminated if you have a 100 kHz crystal. The 100 kHz from the RTLs is run through one section of the SN74H10 to improve the wave shape, that gate was left over from the input IC, so no parts were added. From the SN74H10 the 100 kHz is fed into the first of six decade scalers SN7490. Connected to the first three decade scalers is a four wide two input and-or-invert gate SN7454 together with four sections of hex inverter SN7407 making it possible to select one of four frequencies: 100 kHz, 10 kHz, 1 kHz and 100 Hz. These four frequencies, after going through the last three decade scalers, will give integration times of 0.01, 0.1, 1.0 and 10 seconds. The 0.01 second integration time has no real value in this design and need not be wired. However, if you use less than seven read outs, you will need it to read tens of MHz, it is also useful in checking and troubleshooting.

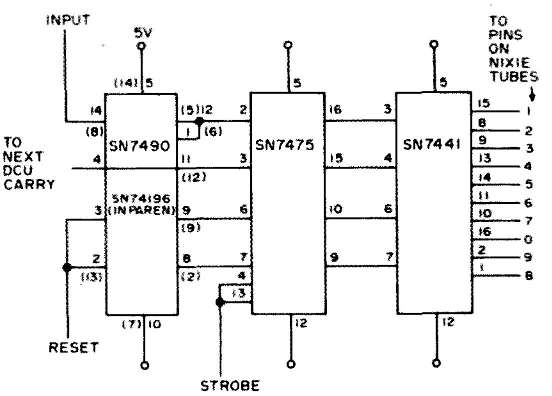


Fig. 4. The SN74196 requires an inverter on the reset. Pin numbers in bracket are for the SN74196. Pins 1, 3, 4, 10, 11 are open. Pin 7 Gnd, 14 +5V.

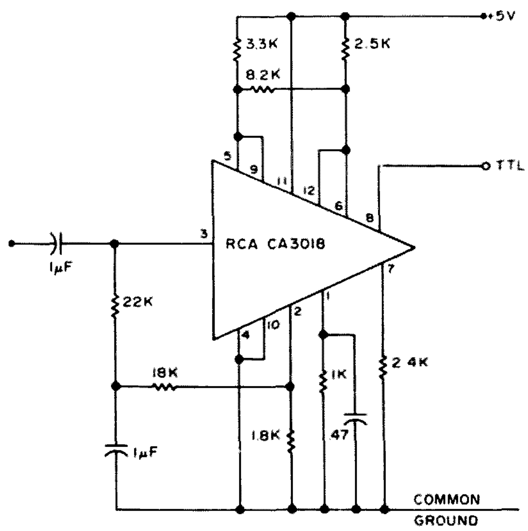


Fig. 5. Input amplifier for low level signals, 20 μV to .4 mV 3 db 800 Hz to 32 MHz.

Power Supply

The power supply uses a transformer rated at 500 Vct 50 mA and 6.3V 1.2A. Using a full wave rectifier on the 500 volts and 40 μF 450 volt capacitor gives approximately 300 volts dc under load. Three 27,000Ω two watt resistors in parallel drops the voltage down to the zener diode rated at 180 volts 10 watts. In series with each Nixie tube, there is a 22,000Ω half watt five percent resistor. The recommended voltage for the Nixie tube is 140 volts at approximately 2½ mA. This arrangement can be changed to fit what you have on hand by changing the series resistor to a value that will assure that no more than 140 volts are on the Nixies. The low voltage supply is a full wave bridge rectifier with 40,000 μF filter capacitor which gives about 8 volts. This is regulated by an IC, LM-390-K, that has a rated output of 5 volts at 1 ampere. The counter draws a little over half of that and runs cold. This regulator is cheaper than building one from scratch and is really better than the ones I have been able to make. The power supply is built right in the 12 x 8 x 3" chassis adhering only to an arrangement that saved as much space as possible. Not shown on the schematic is a minus five volt power supply for the SN72733 which is necessary if you decide to use this system. I managed to crowd in a small filament transformer with a half wave rectifier, 100 μF capacitor and a five volt zener diode. The SN72733 draws less than 30 mA, so not much is required. If you use the CA3018 this is not necessary. If you want to measure frequencies less than 10 MHz only, you could build a transistor amplifier using almost any fast switching type. In that case three or four read outs would be satisfactory. Then there would be no need for the different integration times so the SN7454 together with the switch could be left out. If you really want to cut it down you could use the power line frequency for the time base dividing by six to get .1 second integration, throw in a SN7490 to get one second. I see no reason why this scheme would not work although I haven't tried it myself.

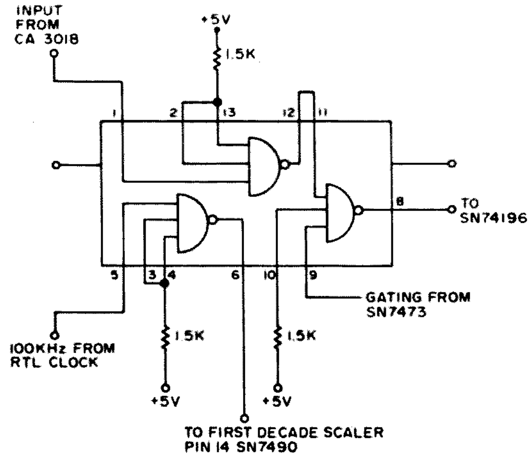


Fig. 6. Input gate using a SN 74H10

Trouble Shooting

Trouble shooting of integrated circuits requires a lot of pre-planning. Following are some of the things I have learned by working with integrated circuits. First, with a piece of hookup wire, jump pin five of the last μL 923 to the input. You should get 100 kHz

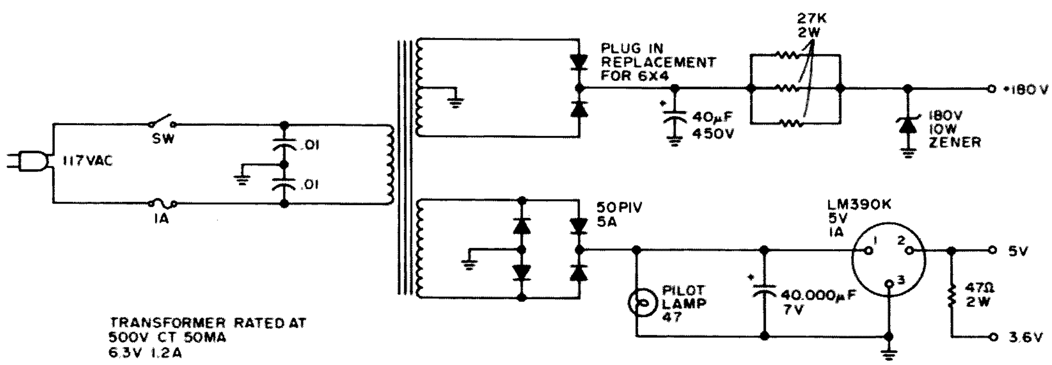
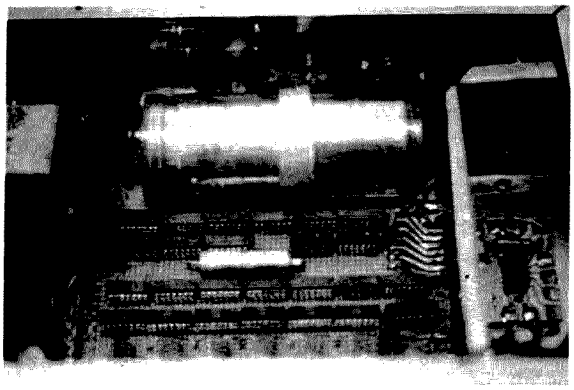


Fig. 7. Schematic of the regulated power supply.



Rear of the counter showing the time base oscillator circuit board and the three 27K power supply resistors mounted behind the filter capacitor.

on all ranges. Do not confuse this as an indication of the accuracy of the counter but as an indication that all systems are working. With a scope on pin 8 of the SN7454 you should get 100 kHz with the switch in the .01 second position, 10 kHz in the .1 second position, 1000 Hz in the one second position and 100 Hz in the ten second position. To check the rest of the decade scalers, put the switch in the .01 second position and follow the signal through the SN7490's by checking the pin 11 of each one, scaling down by a factor of ten for each IC. Finally, on pin 12 of the SN7473, check for the gate opening and closing, and on pin 13, for the timing pulses to the SN7400. Set the switch to the ten second position and measure the gate opening and closing with a VOM. The up's and down's occur pretty fast but it will show on the VOM. Pins 8, 1 and 12 of decade scaler 4 should be nice square waves with the frequency measured depending on the switch position. Pins 1 and 2 of the SN7404, pins 2 and 12 of SN7400 should all be square waves, however, the strobe and reset pulses are hard to lock on even with a triggered scope due to long down to up time.

Using your VOM, momentarily jump pins 3, 4, and 5 of SN7400 to ground and read a high on the reset line. Do the same thing on pins 9, 10, and 11; measure a high on the strobe line. Do not forget the reset on the SN74196 is inverted by one section of the hex inverter. An indication that all is not right is that one of the read outs has a preference for one digit. This can be caused by a bad connection from the SN7490 to the SN7475 or from the SN7475 to the SN7441. A bad connection from the SN7441 to the Nixie tube will show up as no digit on some count and a short will show one digit all the time. Trouble in the strobe line will cause it not to transfer or will flutter during counting. Trouble in the reset line can be detected by a continuous digit on the read out after the input has been removed and sufficient time has passed to reset. Be certain the connections between the SN7490, SN7475 and the SN7441 are correctly wired. An error in this department will cause the SN7441 to decode wrong. This could show up the same as a bad connection; that is, with no input and after the reset there would be some number on the read out. Depending on the cross and how it was decoded would determine what number would be on the read out.

The best bet is to be certain they are correctly wired the first time. If you think I was wrong the first time, you're right.

With a grid dip oscillator couple some rf into the counter using about twenty turns of hook up wire around the GDO coil. Starting at the low end of the dial, 1.6 MHz on mine, slowly increase the frequency until you get up as high as you can, adjusting the wire positioned on the coil to get the best coupling to the counter. Don't be discouraged by dead spots or a frequency difference between the GDO and the counter. The hook up wire will load the GDO down and make the dial read high. Using a tube type Millen GDO I had no trouble getting the counter to work to 50 MHz, after that I had a hard time getting in enough rf to count. I believe this system design would go up much higher in frequency, perhaps up to two meters.

...KL7GGB/4

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AN IMPROVED AUDIO SPEECH PROCESSOR

Richard Silberstein WØYBF
3915 Pleasant Ridge Road
Boulder CO

Increase the effectiveness of your SSB signal with a unit that compresses, clips and filters your audio before it modulates your transmitter.

The advantages of speech processing for single sideband voice transmitters have been pointed out from time to time for a number of years. Speech compression produces some gain in voice power and may reduce peaks substantially if the attack time is fast enough. It offers another advantage of keeping the speaker's voice level constant as his speech power varies or as he moves his head. Clipping increases the relative power of intelligible speech by cutting off voice peaks. Since truncated waveforms produce high-order harmonics whose presence is enhanced in the single sideband mode as compared to AM, it is especially important that clipping be followed by bandwidth-restrictive filters.

Figure 1 is presented to demonstrate the advantages of peak reduction. Figure 1a is a simplified presentation of a portion of a typical voltage waveform of a syllable, as displayed on an oscilloscope with an internally triggered sweep. The spikes contribute almost no intelligence, yet an rf amplifier must not be driven beyond where the spikes flat-top; i.e., saturate the final stage. Most of the intelligence is in the small wiggles. By clipping the spikes and amplifying the useful portions of the waveform to drive the final up to flat-topping, the net intelligible voice power is increased.

The rf envelope of unprocessed speech may look something like Fig. 1b. The width of the spikes increases in a manner suggesting a train of pulses passing through a circuit of restricted bandwidth. The small wiggles are a mixture of intelligible speech and higher harmonics of the repetition rate of the spikes. When peaks are reduced by processing, the waves representing intelligible speech produce rf envelopes which are

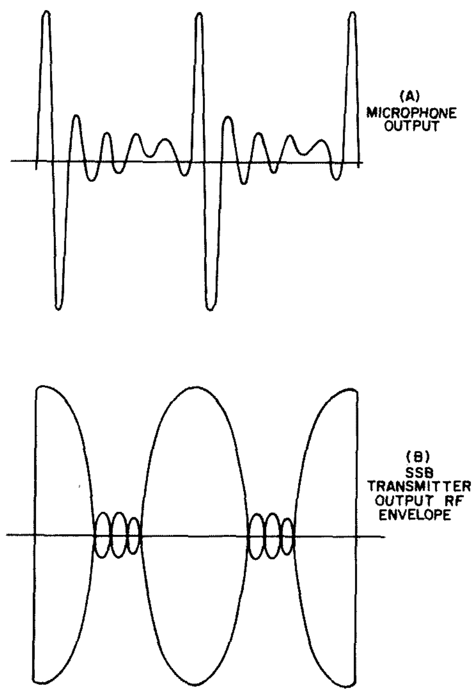

Fig. 1. Unprocessed speech: simplified picture of part of a spoken syllable seen on a triggered sweep.

not exceeded in height by any spikes. In fact, it is difficult to trigger the oscilloscope internally under these conditions because there is no longer a predominant group of spikes.

The speech processor to be described

resulted from an attempt to reproduce the solid state processor of WB2EYZ (see Reference 1), substituting NPN silicon transistors for the PNP germanium types. It was noted in the author's experiment that any appreciable amount of ALC feedback would cause the unit to multivibrate. Even if this was not happening, the ALC voltage would have a sawtooth waveform, which manifested itself in a speech waveform having a sawtooth baseline and a variable gain from one peak to the next. The reason for this behavior is that the ALC feedback circuit, for desirable time constants, will pass frequencies which can be amplified by the amplifier stages.

The above problem was recognized and a solution found some years ago (see Reference 3). If the amplifier whose gain is controlled has a push-pull configuration and the ALC voltage is applied to the tubes or transistors in parallel, then, as a first-order approximation, if the stages are perfectly symmetrical, there can be no AF feedback in the ALC loop. I have designed such a system, followed by an adjustable clipper and a low-pass filter.

The equipment has been designed in accordance with the criterion of an ALC attack time of no more than 10 milliseconds, to insure reduction of initial peaks, and a release time of about 300 milliseconds, to accommodate changes in voice level and yet not permit the background noise to rush in too quickly when the voice is interrupted.

Block Diagram

Figure 2 is a block diagram of the processor. An isolation stage consists of a source-follower FET, offering high impedance to a microphone and driving a single-end to push-pull converter through a manual gain control. This stage drives a push-pull IC amplifier with ALC, whose output is then converted back to single-end. This output drives a two-stage amplifier feeding an ALC voltage generator. It also feeds a clipper and low-pass filter. The clipping level and the filter output are controlled manually. The ALC generator feeds a bias-control stage which provides the correct bias range for controlling the push-pull amplifier.

Circuit Details

Figure 3 is the circuit diagram. The source-follower FET at Q1 is zero biased through R1. R2 is a 91Ω isolation resistor to prevent parasitic oscillations; R1 and R2 join directly at the source contact. Q2 provides audio voltages equal in amplitude and 180° opposed at R6 and R7 to drive a push-pull stage. The push-pull, ALC-controlled amplifier U1 is an RCA type CA3028A integrated circuit, shown in detail with numbered terminals. The transistor below the differential pair controls the gain of the system by means of ALC voltages applied to terminal 2.

The output of terminal 8 of U1 goes to Q3, an emitter follower used to provide a low driving impedance. The opposite-phase output at terminal 6 goes to a phase inverter Q4 driving emitter-follower Q5, which also provides low driving impedance. The outputs of Q3 and Q5 are now of the same phase. Before combining in capacitors C11 and C12, they must be equalized in amplitude. This was done in our case by placing an 100,000Ω resistor, R20, across R21. The combined audio signal, now single-ended, drives the two-stage amplifier using Q6 and Q7.

One output of Q7 goes to the high-impedance input of FET Q8 so as not to apply a distorting load across the audio

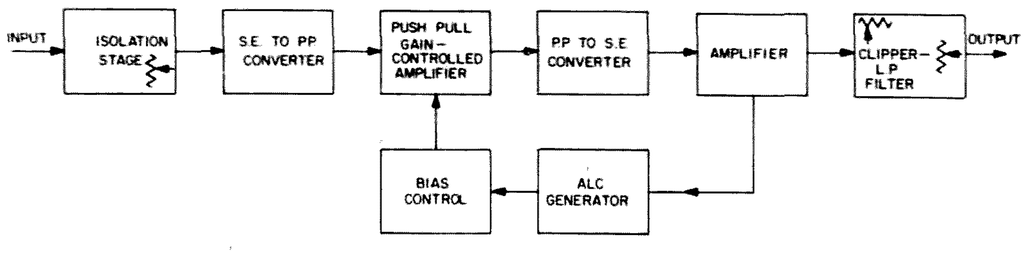

Fig. 2. Block diagram of speech processor.

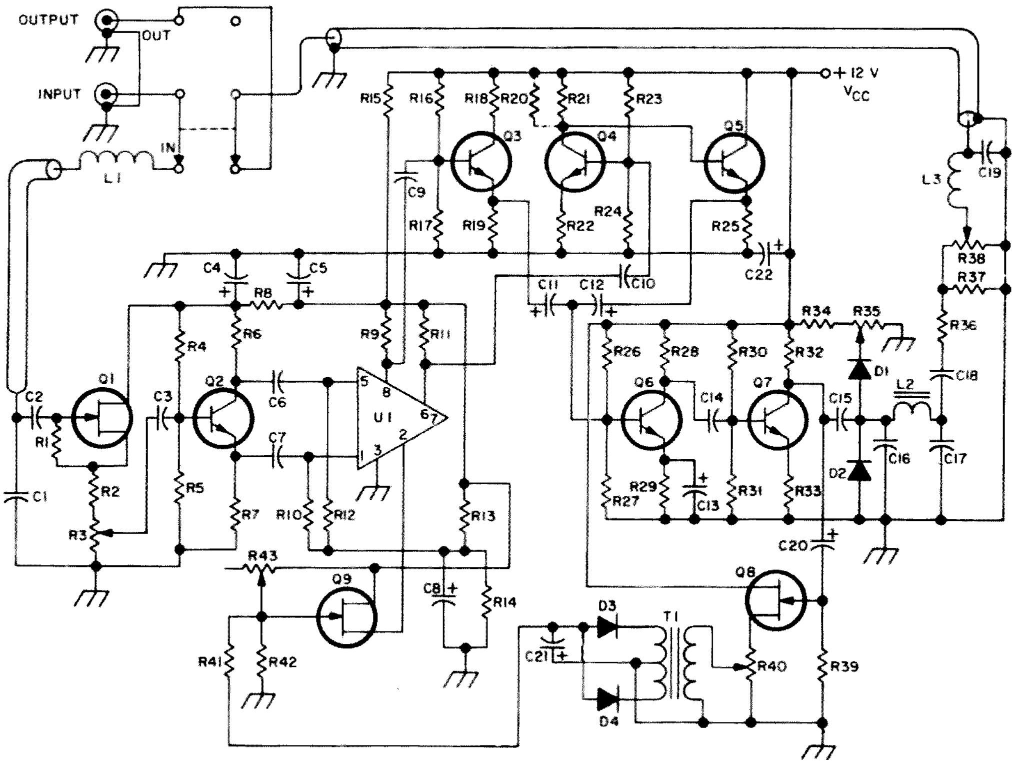

Fig. 3. Speech processor circuitry

output of the system. Q8 is an emitter follower driving transformer T1, which in turn drives a full wave dc rectifier supplying the ALC voltage. The magnitude of the feedback voltage is controlled by R40, an internal 2000Ω 0.1 watt trimmer pot, which is set safely below a point of system instability. Insufficient response to low frequencies, as when the primary T1 is too small, results in too little ALC for the low frequencies and thus overall enhancement of lows in the audio output.

The ALC voltage actuates Q9, a source follower used as bias control for the CA3028A. Q9's source is connected to terminal 2 of the latter. R43 is a high-resistance trimmer pot, or an experimentally determined fixed resistor of perhaps 220K, which may be needed to bring the source current to about 2 mA when the unit is idling. Higher currents made the experiment unit unstable, and lower currents afforded too little ALC. Actually R43 was not installed in that unit; several FET's were tried until one was found which gave the correct current at zero bias. R41 was used essentially to interrupt the dc lead at the gate terminal, so as to avert parasitic oscillations.

The second output of Q7, through C15, is clipped by D1 and D2, with the clipping level adjusted by an external control, R35. At the highest resistance positions of this control, the diode bias voltage is above the level where any clipping occurs, even for the tallest peaks. Filtering is done by the pi network, C16, L2, C17. L2 is the same unit used by WB2EYZ (Reference 1). In that text the values of C16 and C17 were 0.005 μF. However, when those values were tried, the high-frequency roll-off was 3 dB down at only 1500 Hz. When 0.0015 μF capacitors were used, the corresponding point came at 2700 Hz. Neither design was strictly in accordance with theory.

R38 is an externally controlled output potentiometer. Note that the audio voltage is increased by Q7 to insure good controlled clipping. After clipping and filtering it is reduced by the combination of R36, R37 and R38, to produce outputs of similar magnitudes to that of the microphone alone.

Since trouble can be experienced with rf feedback, microphone and other audio cables should be short. L1C1 and L3C19 are

for rf filtering. The inductors can frequently be omitted.

The 12V power source can be a battery or a well-filtered ac-powered supply. The small imported units which plug directly into an ac socket work nicely.

Operation

The ALC behavior of the unit at full gain at 1000 Hz is shown in Fig. 4. The input reference level was selected arbitrarily as 31.6 mV rms (10 dB above 10 mV), since this is near the highest value of intelligible speech output for the most sensitive microphone used in the tests, an RCA HK 107. The data show only a 2 dB drop in output for a 20 dB drop in voice level (18 dB of compression), and an 11 dB drop in output for a 40 dB drop in voice level (29 dB of compression).

High gain settings of R3 correspond to heavy compression. But when the voice is interrupted, too much gain may result in the appearance of undesired audio signals: background noise, hum and breathing sounds, as well as room echo. At top values of R35 there is no clipping, but as values are decreased, the highest peaks begin to be clipped. For somewhat lower values, the intelligible portion of the waveform begins to be truncated and the output amplitude is lowered. This loss of gain must be made up by increasing the settings of R38. The system, surprisingly enough, is usable even with the severely truncated speech waveforms observed on an oscilloscope when R35 is set to zero, but, the more severe the clipping, the stronger the undesired audio signals relative to the desired signals. With reduced compression and heavy clipping, some undesired signals may be present all the time.

Tests were made to measure the effect of the processed speech upon a receiver S meter, and to evaluate real gain in intelligible speech. The unit was used to modulate an old Viking Invader 200 watt p.e.p. transmitter driving a dummy load. For each setting of the processor controls and for no processor, the system audio gain was adjusted to just below rf flat-topping.

In testing with voice signals for the various conditions of the processor, essentially no change occurred in the S meter reading in an R4B receiver. This is attributed to the fact that the receiver AGC has a fast attack time, so that it gave the same response to a spike of the uncompressed speech driven just below flat topping, as to a burst of processed speech driven to the same level. Other tests gave different results, however.

A well shielded receiver (Hammarlund SP-600) was connected by means of cables through an rf decade step attenuator to a few feet of wire as an antenna. For significant attenuator readings, the system was operated with never less than 20 dB dialed into the attenuator so that antenna always looked into a 50Ω load. The transmitter

PARTS LIST

Fig. 3. Components

Q1,Q8,Q9 FET-1, HEP 802, 2N3819, etc.
Q2-Q7 2N697, HEP 54
U1 CA3028A D1-D4 1N270
L1-L3 2.5 mH rf choke
L2 3.5 H miniature audio choke, UTC DOT-8
T1 GC Co. D1-728 transformer. For primary, use half of 500Ω CT secondary. For secondary, use 1000Ω CT primary.

Capacitors

C1, C19 0.001 μF
C2 0.005 μF
C3 0.05 μF
C4, C5, C8, C22, 100μF 15V
C6, C7, C9, C10, C15, C18 0.1μF
C11, C12, 10 μF 15V
C13 30 μF 15V
C14, 0.02μF
C16, C17 0.0015μF
C20, C21 6 μF 1.5V

Resistors (all except potentiometers 1/2 watt)

R1 2.2M
R2 91-R3 10K audio-taper pot
R4, R16, R23, R26 180K
R5, R17, R24 56K
R6, R7, R18, R19, R21, R22, R25, R34 4.7K
R8, R14, R15, R29, R33, R41 1.0K
R9, R11 10K
R10, R12, R37 47K
R13 2K
R28, R32, 3.9K
R30 120K
R35 5K pot
R36 24K
R38 50K audio taper pot
R39 100K
R40 2K trimmer pot
R42 30K
R20 See Text
R27, R31 33K

dummy load was fed through a T connector so that a few inches of wire could be connected to the high side as a transmitting antenna.

An admittedly crude set of tests of listening to oneself was conducted and the step attenuator adjusted to something resembling equal intelligibility of processed speech after unprocessed speech had been used. With almost full ALC, the RCA HK 107 microphone showed 5 or 6 dB of voice power advantage for a variety of processing adjustments, even though the transmitter already had some built-in ALC.

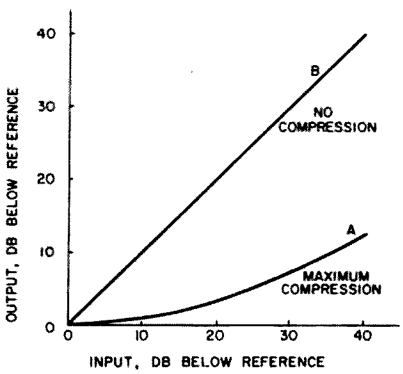

Fig. 4. Compression characteristics: a. maximum compression; b. no compression.

Another indication of enhanced speech power was that during transmission with various processor settings and with the transmitter always adjusted just below flattopping by any portion of the speech waveform, an rf wattmeter showed three to over four times the average output power of unprocessed speech.

On-the-air tests uniformly brought comments that the processed signal was better than the unprocessed signal, the best quality being with heavy compression, associated with fairly high input gain, and a moderate amount of clipping. Less compression with severe clipping appeared more distorted, but very readable, to some listeners. This adjustment seemed to some to be "the kind of thing to get through in a pile-up."

One reason the processed speech is superior to the unprocessed speech appears to be because the time intervals between the spikes of Fig. 1 are now filled with intelligible speech, where noise or interference might otherwise take over. This "fullness" is quite noticeable and beneficial, even though the speech is only of communications quality.

No doubt a directional or noise-cancelling microphone should permit the use of greater gain or more clipping; efforts should be made to eliminate sources of hum and rf pickup as well as of equipment audio hum.

It is evident that with equipment designed to operate below the legal power input limit, the useful sideband output may be increased by at least 6 dB, with comparable input increase. However, one has to be concerned as to whether the output-tube dissipation and the power-supply capacity will handle the extra load; i.e., the linear dynamic range of the output stage has to be the limiting factor in power-output capability. The author's old Viking Invader meets these requirements. When a linear final amplifier is used, legal limitations make it necessary to see, in the United States, that the average input does not exceed 1 kW under processing conditions.

Conclusions

The speech processing unit described above offers the user a flexible modulation system with the capability of controlling a number of parameters in order to optimize transmitter output in accordance with the user's voice and operating habits, and the characteristics of the rf equipment he is modulating. It should be especially useful in "beefing up" low-power gear. The effectiveness of all solid state transmitters should be enhanced by incorporating speech processing circuitry similar to what has been described.

...WØYBF

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A TWO-TONE TEST GENERATOR

In the testing of amplifiers and other devices associated with Single Sideband systems, the two-tone test has achieved a great degree of acceptance. Regardless of how the test is performed, whether looking at the output of the device under test with an oscilloscope (amplitude vs time) or with a spectrum analyzer (amplitude vs frequency), the basic input requirement is two good sine waves. In the laboratory, such a two-tone signal is usually obtained by using two good quality audio oscillators, like the Hewlett Packard 204C, and a resistive adding network.

In amateur testing, two-tone audio test signals are usually of much poorer quality, being derived from mike-preamps switched into oscillation by various types of frequency-dependent feedback networks.[1] Even commercial "station monitor" systems often use only a pair of simple phase-shift oscillators (without *negative* feedback or automatic amplitude control). Although such simple methods of obtaining test tones are useful, they often yield test tones in which each sine wave contains appreciable distortion (contains harmonics), and this lack of purity can be incorrectly ascribed to distortion in the system under test. Basically, what it comes down to is that if your input tones aren't pure, you can't really tell how much distortion is from the test tone generator and how much is from the system under test. A really good two-tone test generator will help us to "separate the sheep from the goats."

The two-tone generator described here uses two of the same basic Wien Bridge oscillator circuits as are used in most laboratory-type audio generators. However, by using modern Integrated Circuit (IC) Operational Amplifiers (op amps), each Wien Bridge can be built around a single semiconductor package. Op amps are also used as active bandpass filters to further clean up harmonics of the two oscillators, and to sum the two pure tones. The block diagram of the generator is shown in Fig. 1.

The particular oscillator circuit used is a form of Wien Bridge originally described by Bob Botos of Motorola.[2] Its charm is that he uses a pair of back-to-back silicon diodes as the non-linear control element. Such a pair of silicon diodes is probably much more readily obtained, and less expensive, than a particular light bulb or thermistor – as used in most Wien Bridge circuits. The diodes prove to be very effective as non-linear elements; and they do not cause severe waveform clipping because of the 47K resistor in series with them. The 1K pot that is in the same arm of the bridge as the non-linear diode elements (R1 or R2), is used to set the oscillator level. This pot should be set to give a 10V peak-to-peak output at T.P. 1 (and T.P. 2).

The active bandpass filters that follow each audio oscillator are described in detail in References 3 and 4. The use of this form

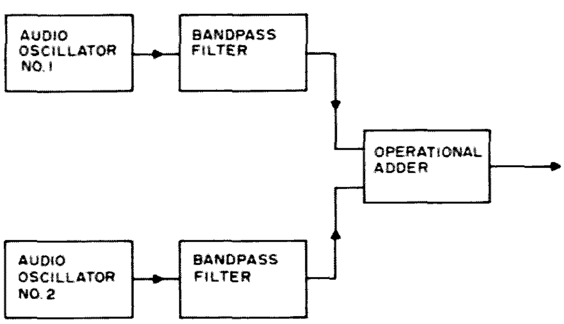

Fig. 1. Block diagram of the tone generator.

of active bandpass filter as a single-control variable-frequency audio filter is apparently due Bob Dobkin.[5] An idea of how a filter composed of nothing much more than R's, C's, and an operational amplifier can have selectivity, can be gained as follows. The R-C network that controls the frequency is connected between the output of the op amp and its inverting input – that is, in the negative feedback path. The R-C network is reminiscent of the bridged-tee *null* network. At the network null frequency, the negative feedback is the lowest, and therefore the closed-loop amplifier gain is the highest. The frequency of the passband is adjusted by means of the 1K pot in the R-C network to match the oscillator frequency. (Adjust R3 for a maximum 2000 Hz output at T.P. 3, and adjust R4 for a maximum 800 Hz output at T.P. 4.)

The particular IC op amps used in the active bandpass filters are LM301A's by National Semiconductor. These op amps are compensated in a way referred to as the "feed-forward" method of compensation. This way of compensating op amps allows them to have higher slew rates than with the normal single-capacitor compensation usually used with LM301A'S. The "feed-forward" compensation method is described at some length in Reference 6. Because this type of compensation is used in the active bandpass filter op amps, it would probably not be too good an idea to use other types of op amps here. The op amps used in the oscillators and operation adder, however, can be any of a variety of types. The MC1456 of Motorola or μA741 of Fairchild should serve well in these positions (with the 33 pF compensation capacitors omitted). Of course, there are a number of exact equivalent of the LM301A, MC1456, and μA741 made by a variety of companies other than the originators – these are not to be considered replacements but second sources. One could probably even use μA709's if he understands how to properly compensate them (and wants to go to all the bother); but if you are at all uneasy about substitutions, use LM301A's throughout and the circuit of Fig. 2.

The last stage is the operational adder, or summing amplifier. This op amp is operated at a closed-loop gain of 1. The summing point of the two pure sine waves (2000 Hz and 800 Hz) is at the inverting input of the op amp. As connected, this port is a "virtual" ground; if you look at this point with a

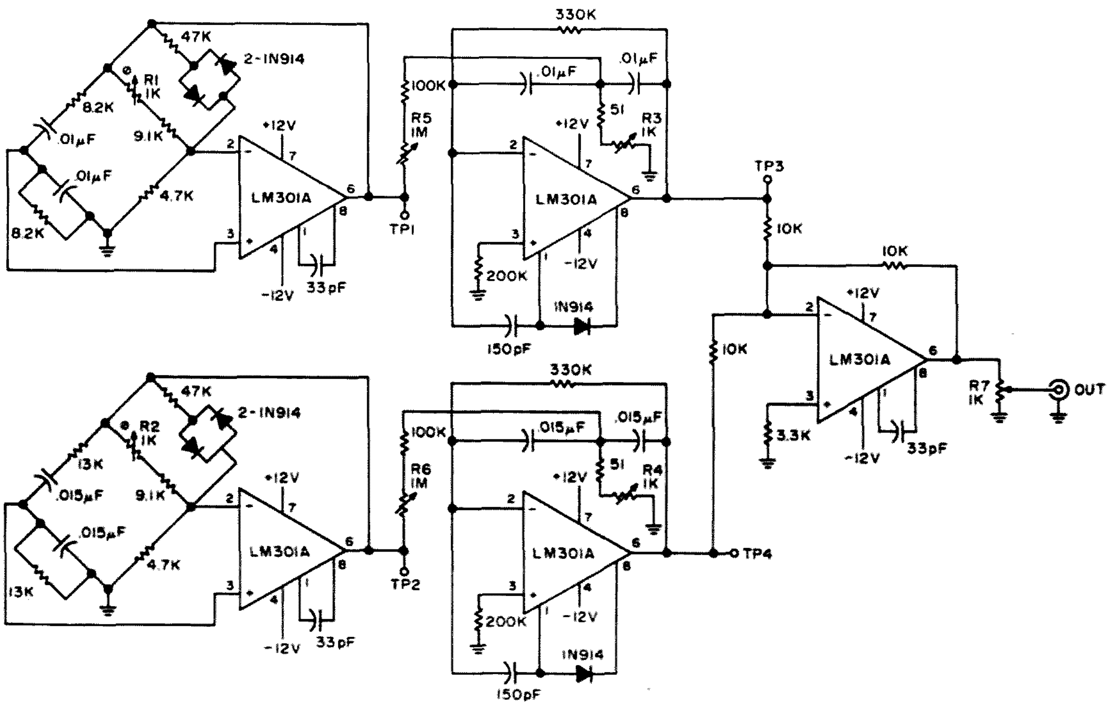

Fig. 2. Schematic diagram of the two-tone test generator utilizing Wien Bridge oscillators.

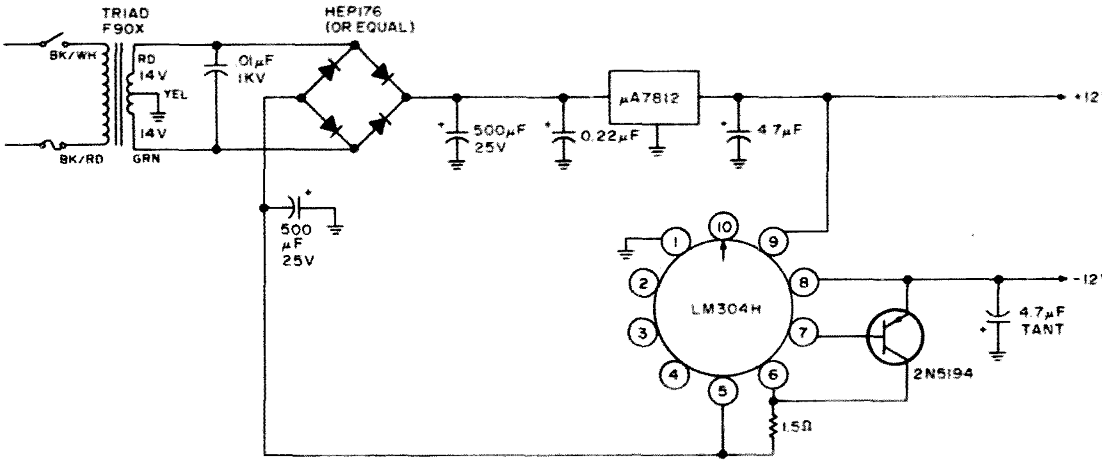

Fig. 3. Dual voltage regulated supply used to power the tone generator.

scope you will see nearly zero voltage. This is simply because the (high gain, 80 dB) op amp strives to keep the differential voltage between inverting and non-inverting input at zero, and so the non-inverting input is effectively grounded. So each sine wave "sees" the summing amplifier as 10K to ground; and the two sine wave generators cannot interact with each other to cause distortion. The summing amplifier is a true algebraic summer, which is why operational amplifiers thus connected were originally used in analog computers. If one sine wave is instantaneously at +5V and the other is at −3V, the output will be +5 −3 = +2V. And since there is no coherence between the 2000 Hz and 800 Hz sine waves, we can expect to see plus and minus voltages as high as twice the peak value of each sine wave (±10V peak, or 20V peak to peak). This should be more than enough level for most two-tone testing. The level of each sine wave can be controlled by the 1 Meg pot at the input to each active filter (R5 and R6).

Measurements of the output of the two-tone generator described above, with a General Radio 1900A Wave Analyzer, show that (for equal level tones) the harmonics and cross products are all down more than 70 dB from the desired tone. This sort of purity should be more than adequate for testing any amateur communication system.

A simple, but well-regulated power supply for the two-tone test generator is shown in Fig. 3. An integrated bridge rectifier is used with a center-tapped secondary transformer as a plus and minus full wave rectifier. Plus 12V is simply obtained by use of one of the new fixed-voltage three-terminal regulator IC's of Fairchild, the μA7812. This IC looks like a plastic power transistor (UGH 7812 393) and its common terminal is the heat sink lab. So screw it right to the chassis if you want to – with no mica washers, grease, etc.

The negative regulator is slightly more complicated, but still simple. The National Semiconductor LM304H is used, with the regulated +12 serving as its reference voltage. In this way the plus and minus voltages *track*. A 2N5194 plastic power PNP transistor is used to increase the current capability of the LM304H. The 2N5194 must be heat-sinked in a conventional way, using insulating washer, etc., if the chassis is used as the heat sink.

...W6GXN

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EDITORIALS

The editorials in 73 pull no punches. Nothing wishy-wshy. It is safe to say that unless you read the editorials in 73 you cannot know what is really going on in our hobby.

Did you enjoy the article in August on the DXpedition to Navassa? This is one of the reasons that 73 is different – it is involved. The editors get out there and operate, go on DXpeditions, organize them even – organize ham tours – set up repeaters – work in the contests – work lots of DX – are actually on slow scan – on RTTY – it makes the magazine come alive. When the editors write about something you know that they have the background to bring you the inside scoop.

HOW TO SUBSCRIBE

If you prefer not to shred your copy of 73 there is no real reason why you should not put the subscription information on a separate piece of paper, on the margin of a hundred dollar bill, or whatever turns you on.

Regular subscriptions ordinarily start with the next published issue of 73. If you want otherwise just indicate same on the order.

The regular subscription rate for 73 is $6 for one year, $11 for two years, $15 for three years in North America and $1 extra per year for foreign subscriptions.

The recent serious rise in postal rates will be forcing 73 to increase the subscription rate soon – don't say you weren't warned.

AMATEUR RADIO IS MORE FUN WHEN YOU READ 73!

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SPECULATIONS ON FUTURE DX

Most radio amateurs in the world know that the sunspots control ionization of the upper atmosphere, hence DX propagation. But not many of them pay much attention to propagation – amateur radio is their hobby and they either "get through" on a QSO or they don't. If conditions are "bad" they accept the situation and work contacts closer to home.

There are a few amateurs, however, who are definitely interested in the sunspots in a scientific sense and the relationship to DX propagation. These men wait for the Zurich Solar Observatory results each month and carefully watch the various forecasts. Like these men, I have been interested in the sunspots for many years and each month plot the results from Zurich.

We have some history of the sunspot counts since 1749. This article considers this past history, and speculates on what that history may be trying to tell us. It also speculates on what the sunspot story might be in the near future and correspondingly, what DX propagation might be. Some suggestions are included as to how amateurs might cope with low DX propagation conditions.

Figure 1 shows the past history of the sunspot counts. It is plotted by years using the 12 month running smoothed sunspot numbers on the vertical axis. Years are used on the horizontal axis. Also shown are the cycle numbers, from 1 to the present cycle 20, which will end about the middle of 1975.

Before looking at Fig. 1 in detail, let us agree that the results shown are not finite. They are the results of telescopic observations of the sun made by numerous ob-

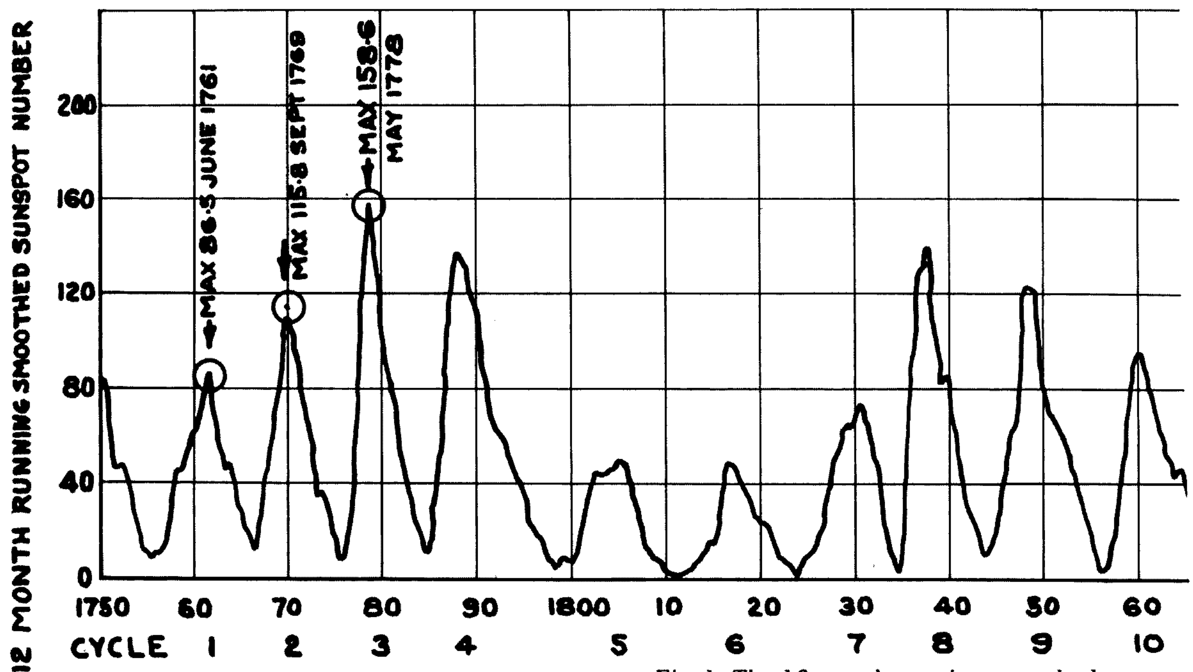


Fig 1. The 12 month running smoothed sunspot

servers. Since the sunspots themselves may only last for a short interval of time, counts between observers may vary. This was recognized in 1849 by Rudolf Wolf, Director of the Zurich Solar Observatory, when he developed the formula to care for the variations in observers, their equipment and their observations. His formula is still in effective use today. So we will not concern ourselves, in general, with the actual sunspot numbers, but rather look at the broad picture presented in the past history available to us.

Now, looking at Fig. 1 we note some interesting points –

1. Cycle 1 seems to start increasing activity on the sun's surface. Cycle 2 was greater, cycle 3 quite high, then the activity fell off. Cycle 4 was lower and cycles 5 and 6 quite low. After the activity of cycles 1, 2, 3 and 4 did the sun "rest" from 1798 to 1823, about twenty-five years or so?

2. In cycles 7, 8, 9, 10 and 11 there was an increase in activity, but seemingly of a random nature. Cycles 12, 13 and 14 were much lower in activity, but higher than cycles 5 and 6. Was the sun's thermonuclear reaction "resting" again after the activity of cycles 8, 9, 10 and 11?

3. In cycle 15 increased activity took place, but this may again have been of a random nature since cycle 16 decreased considerably following it.

4. Cycle 17 started off fairly high, followed by increased activity in cycle 19. Cycle 20 seems to have repeated the falling off of cycle 4, although of somewhat lower value.

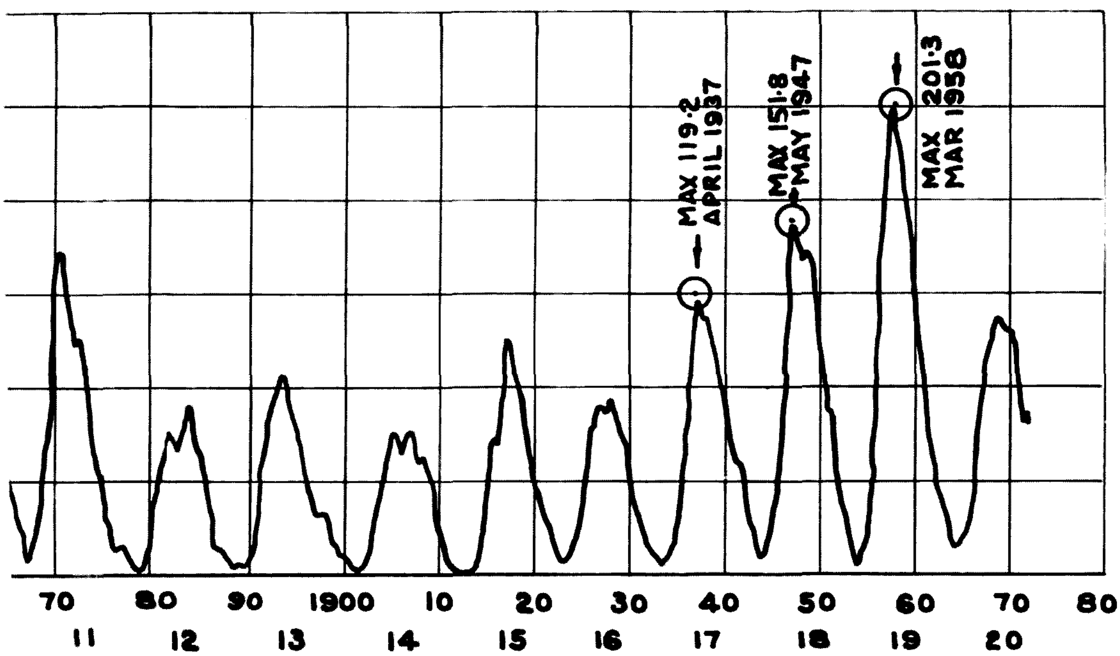
In all our thinking on these points there are several thoughts we must keep in mind –

1. We cannot expect to develop anything more than generalizations from the past history of the sunspots since we have only a little more than one complete overall cycle of operations of the sun to consider.

For our purposes we may consider one complete overall cycle as being the length of time from one maximum cycle to the next maximum cycle. For example, this could be the length of time between the maximum of cycle 3 to the maximum of cycle 19, or about 178 years.

2. We have only one overall cycle to analyze and in the history of the individual cycles we have only 19. There is no regularity to the individual cycles. The average cycle appears to be 11.08 years. The individual cycles may vary widely (see Fig. 1).

Some Fourier analysis studies were made in Washington some years ago and tended to indicate a secondary cycle of about 160–170 years in length. However several overall cycles, say at least 2, or 320–340



numbers plotted by years from 1750 to 1971.

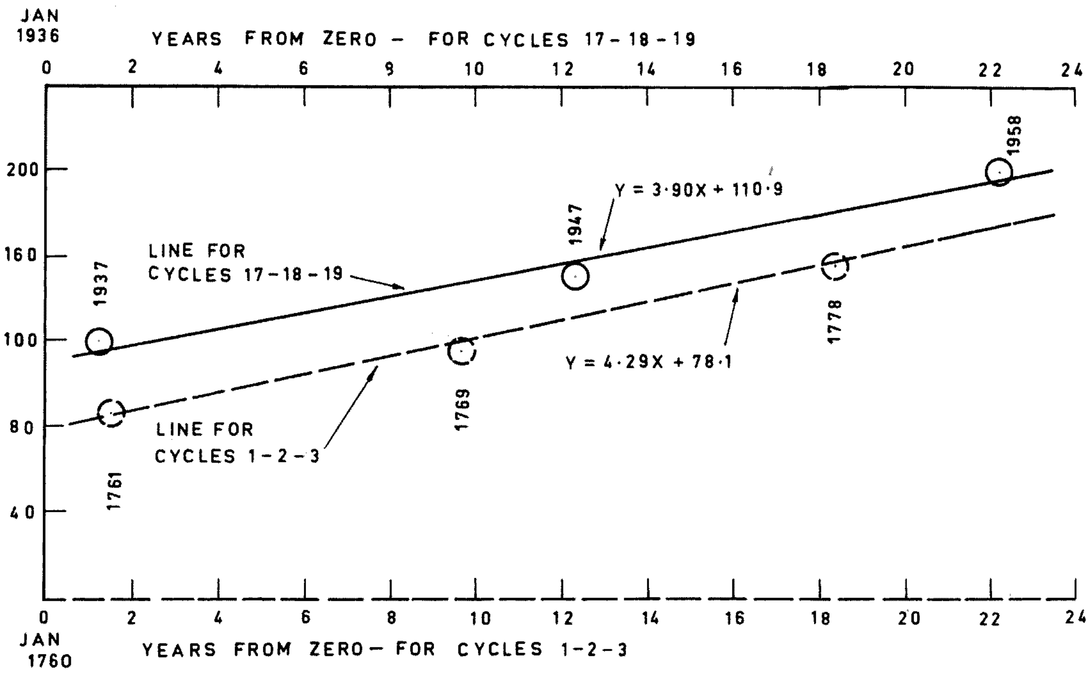


Fig. 2. "Lines of best fit." See text.

years, with associated records, must be obtained before we will be able to conclude there is this overall cycle in addition to the 11 year (approximate) cycles.

The increases shown in cycles 1, 2 and 3, 17, 18 and 19 seem too similar to me to be discarded in our thinking. Let us look at them in more detail. To simplify the mathematical work, only these cycles will be considered.

If we lay a straightedge along the peaks of cycles 1, 2 and 3 and the same on cycles 17, 18 and 19 the "line of best fit" for each group seems to be at about the same slope.

The next step is to check these "lines of best fit" for each group, using the usual mathematical procedures. To do this we must establish "zero dates' for the mathematical procedures. For cycles 1, 2 and 3 I have used Jan. 1760 for the zero date, in order to find the equation which represents the "line of best fit" for them. Similarly, Jan. 1936 was chosen for cycles 17, 18 and 19.

After completing the mathematical work we find we have developed two equations –

Cycles	Equation
1, 2 and 3	$Y = 4.29\,X + 78.1$
17, 18 and 19	$Y = 3.90\,X + 110.9$

These equations represent the lines of best fit. In themselves they do not show what we want – they must be charted to show their relationship. This has been done in Fig. 2.

Examination of this figure indicates the lines to be nearly parallel. Differences in counting the sunspots by the various observers around the world could account for the small amount by which the lines are not parallel. This is not significant to us, what we are interested in is that the lines are nearly parallel.

So the sun, in its activity in cycles 1, 2 and 3, almost duplicated that activity in cycles 17, 18 and 19. Improved telescopes, more trained observers and better observatory conditions might account for the fact that more sunspots were counted in cycles 17, 18 and 19 than in cycles 1, 2 and 3.

This brings up the question, could this indicate a regularity in the sun's behavior? Does the sun's activity peak every 160–180 years, then a short resting period follow? To obtain an answer to this question we must have more evidence, more complete data on the sun's overall cycles.

Another question might be asked. After each burst of activity of the sun, does a resting period always follow? If this is true,

then cycle 21 could be quite low in activity, with a maximum annual mean of about 40–45.

Fortunately we will be able to estimate quite soon what cycle 21 will be like. Cycle 20 is expected to be complete about the middle of 1975 and then cycle 21 will start. If it will be a major cycle, it should start up and increase quite rapidly, month by month. If it is going to be a low cycle, it will increase quite slowly, month by month. The first year should "tell the tale"; i.e. by midsummer of 1976 we should have a fairly good estimate of the maximum activity expected for cycle 21. The maximum should take place about the middle of 1979.

What we will watch for is the "rate of change." Figure 3 shows an example of this action Cycle 19 has been plotted for a few years to show the fast rise in the first few years (up to a maximum of 201). Cycle 20, a lower cycle of maximum 111, is also plotted. Note the difference in the rate of change in the early years.

Some of the other cycles also show this quite clearly, for example – the fast rise in cycle 3 compared to the slow rise of cycle 6.

If my analysis is reasonable and the sun does rest after a period of activity, then we might expect one or two low sunspot cycles to follow cycle 20. These could last anything up to, say, 25 years in length. In this case, if it is to happen, there could be some things we should be starting to do now to get ready for low sunspot activity. Some of the things we might do are as follows –

1. More listening for DX openings. These could last only a few hours – take advantage of them in the time they are available.

In his book *Ionispheric Radio Propagation* Kenneth Davies, of the National Bureau of Standards, makes the statement "The daily values of R vary betweeen 0 and 355 or more." Imagine the band openings for a short time if there was an R figure of 355!

Most DX amateurs know of the possibility of these openings. One day last summer a station in the Indian Ocean was putting a 59 plus 10 dB signal into North America. The condition lasted for just about two hours. I haven't heard him since.

So let us watch for these openings, even if they are of short duration.

2. If the sun rests after a burst of activity then there will be fewer disturbances.

3. On 10 meters I would expect definitely reduced working hours.

4. A fair reduction of good openings on 15 meters.

5. 20 meters may expand in working time.

6. 40 and 80 meter openings should expand.

7. Work should be done to increase the height of the average beam or quad antennas, to obtain the lowest forward angle of radiation.

8. We should all make an effort to help the cause of amateur satellites and learn how to use them effectively.

9. Our operating procedures could be improved.

The amateurs living today are fortunate to have been through the past years and to have had the opportunity of working during cycle 19. What will happen to the sunspots in future years is a function of time. It will be most interesting to continue to follow the monthly sunspot numbers from Zurich and ultimately to determine whether or not some of our conclusions are correct.

. . .VE3CEA

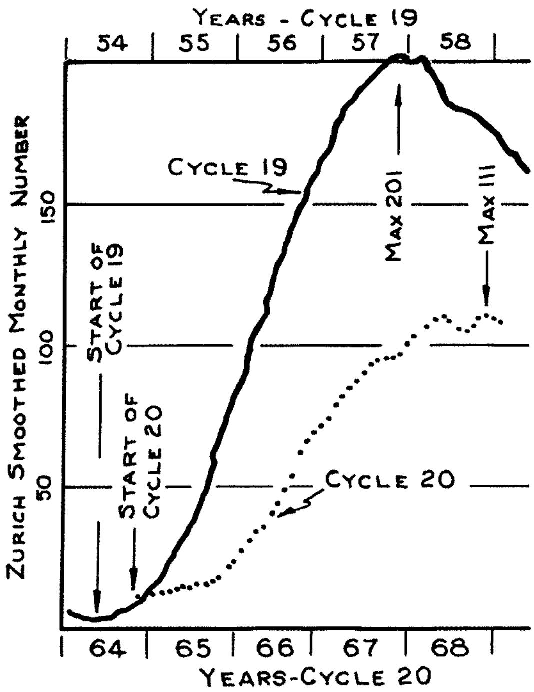


Fig. 3. Rates of increase for a small and large activity cycle.

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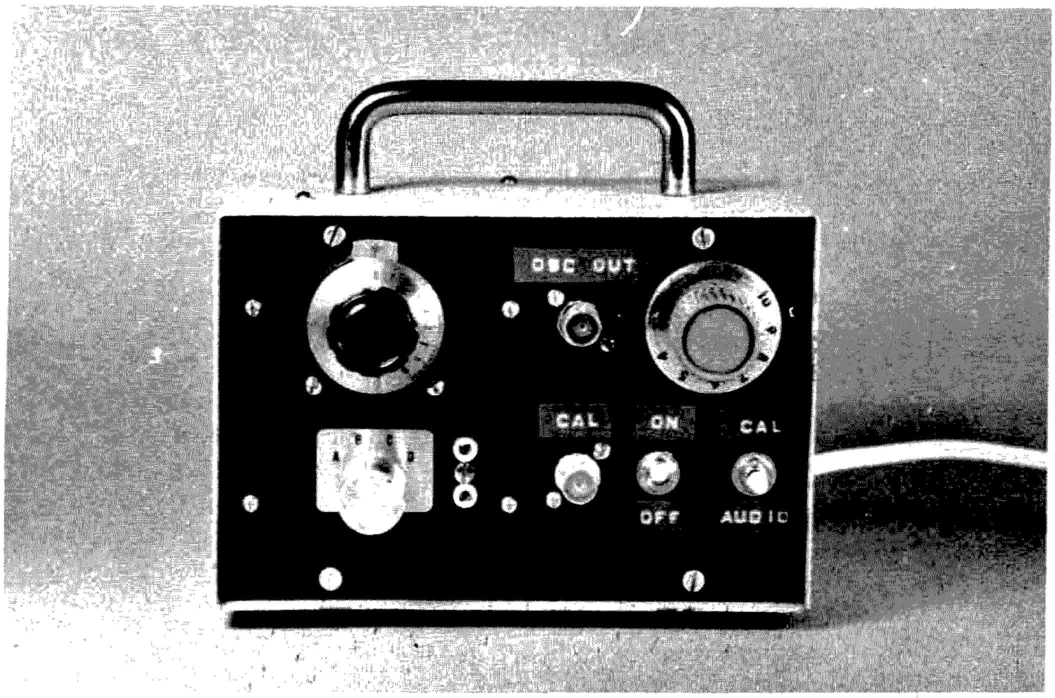


FM TEST SET

How would you like a test set with the following features:

1. Frequency meter for the receiver as well as transmitter.
2. Signal Generator with calibrated output.
3. Deviation checker (with associated equipment).

The need to build up a compact unit came after carrying some heavy test equipment up to a remote amateur repeater site. This test set will also be very handy for checking and aligning your two meter mobile or base station. It is also useful for checking out commercial mobiles if the frequencies are compatible.

Theory of Operation

The crystal oscillator uses one transistor Q1 which is rich in harmonics up to about 450 MHz. The output of which is varied by using a potentiometer to vary the supply voltage. A crystal that will multiply out to

the desired frequency is inserted and put on the exact frequency with variable capacitor C1. This unit in conjunction with an external variable attenuator provides an accurate rf signal source. The mixer consists of the emitter-base junction of a VHF silicon transistor to combine the output of the crystal oscillator with a small portion of the output of the transmitter to be checked. An audible beat will then be heard out of the audio amplifier for frequency adjustments if necessary. The crystal calibrator generates outputs every 30 kHz and is derived from a 3 MHz crystal oscillator and two divide by 10 ICs to give the 30 kHz markers. The harmonics of this device are usable to over 150 MHz. A receiver can thus be put on frequency provided that the receiver is operating on a standard 30 kHz spaced channel. The transmitter can be put on frequency indirectly, a receiver on the same frequency is first put on frequency with the calibrator. The crystal oscillator frequency is then compared and adjusted using the receiver. The transmitter to be tested now is mixed with the crystal oscillator and put on frequency by listening for a zero beat. Deviation can be checked out in conjunction with a receiver and a dc scope. The crystal oscillator is first calibrated 15 kHz below and above the desired frequency. The output of the receiver discriminator is attached to the vertical input of the oscilloscope. The scope can now be calibrated and the transmitter deviation can be checked.

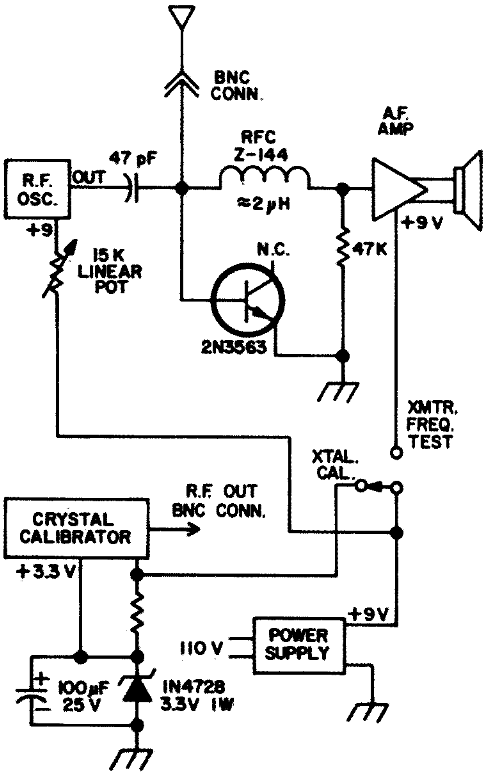


Fig. 1. Overall block diagram and mixer details.

Construction

The complete unit measuresonly 6¼ by 4¼ by 3½ inches. Four separate PC boards were used for building the crystal oscillator, amplifier, power supply, and the crystal calibrator. The overall block diagram is shown in Fig. 1. The crystal oscillator schematic and board are shown in Fig. 2A and B. The frequency of the unit isne not

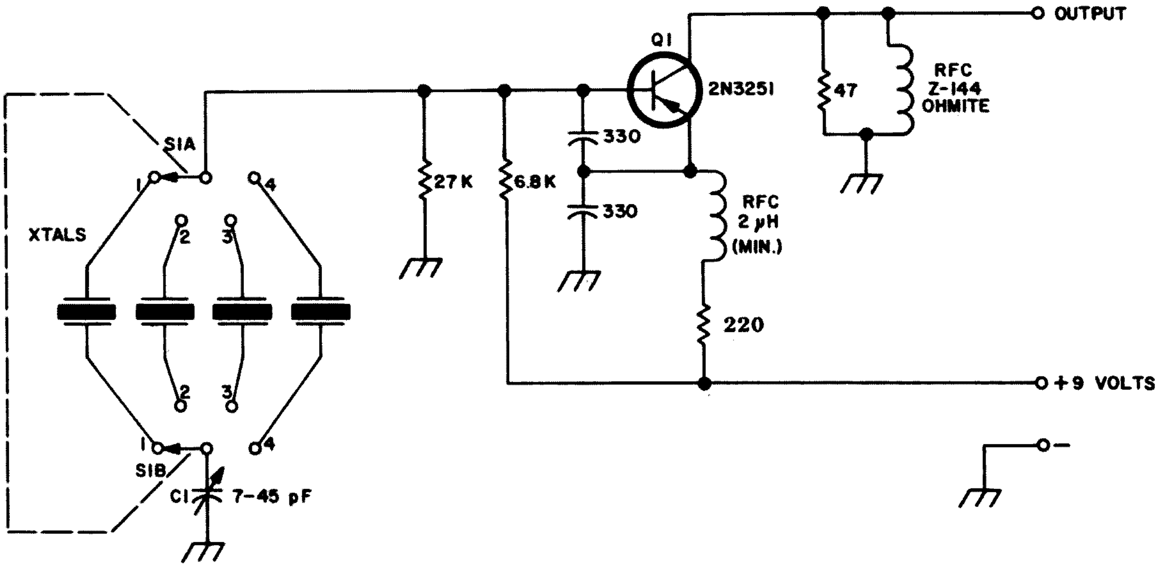


Fig. 2a. Schematic of the crystal oscillator.

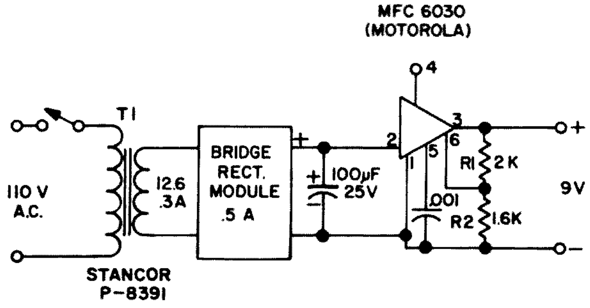


Fig. 4a. Power supply schematic. Voltage can be varied by changing the R1/R2 ratio.

tor. The schematic and P.C. board are shown in Fig. 4A and 4B.

Operation

The crystal calibrator can be used to check any two meter channel provided it is a standard 30 or 60 kHz spaced one. To determine if the frequency to be checked is standard just divide by 30. It must work out evenly; e.g. (146.94 will divide by 30). The receiver padder can now be adjusted for a zero discriminator reading. The transmitter is checked indirectly by using another receiver and the crystal oscillator. Suppose that you would like to check the frequency of a transmitter on 146.94. You must first apply the calibrator to the receiver and verify that the receiver is on frequency. Next a crystal with the right multiplication is inserted in the test set and adjusted on frequency using the calibrated receiver. A short piece of coax is placed near the transmitter to be tested and adjusted for a zero beat (switch to TX frequency).

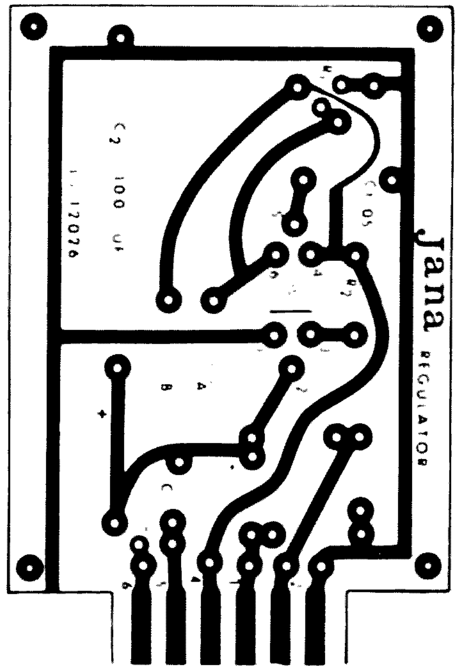


Fig. 4b. Full size layout of power supply board.

Deviation Checks

Deviation can be checked in conjunction with a receiver and a dc scope. First the crystal oscillator in the test set must be calibrated against a good standard for a frequency plus or minus the desired frequency. A calibration chart can be made up for each crystal desired. The output of the test set is now applied to the receiver. The discriminator output of the receiver is applied to the vertical input of the scope. Vertical calibration is accomplished by moving crystal oscillator from desired frequency to plus or minus 15 kHz for a reasonable scope display. The scope is now calibrated and modulation can be applied to the transmitter under test.

Calibrated rf Generator

The crystal oscillator in the test set in conjunction with an rf attenuator can be used for an accurate calibrated rf source.

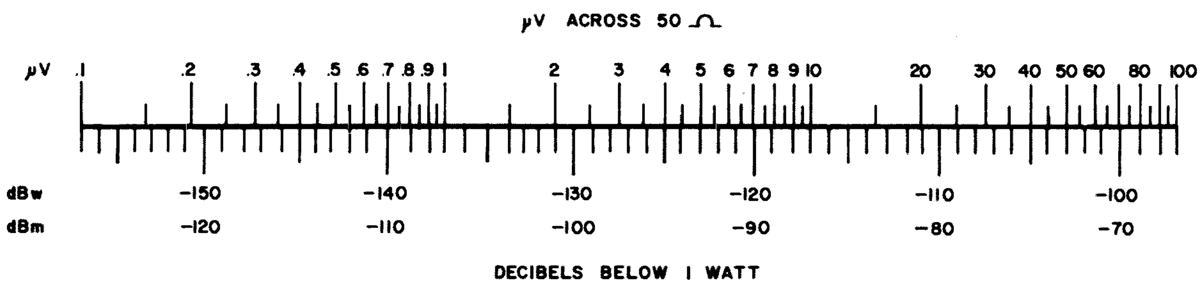


Fig. 5. Chart to be used in conjunction with the crystal oscillator and an rf attenuator.

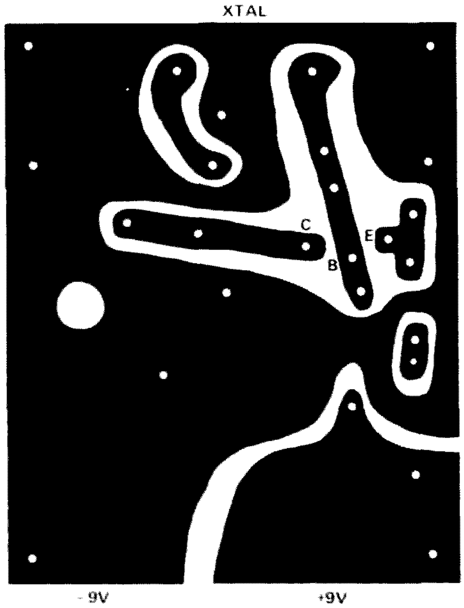


Fig. 2b. Full size layout of crystal oscillator P.C. board.

with C1 variable capacitor which is rotated using a vernier dial. Switch S1 can have as many positions as desired. It is advisable to mount one of the crystal sockets on the front panel. The output level is adjusted with a 15,000Ω pot and should be linear taper for smoother output variation.

The audio amplifier uses a TA300 IC to produce about 1 watt output. The speaker used came from an old transistor radio. Any high gain amplifier could be used here. A VHF silicon diode is required for the mixer. One was not readily available so the E-B junction of a 2N3563 transistor was used.

The crystal calibrator schematic is shown in Fig. 3. The unit is available in kit form. I priced out the individual components and found that it was less expensive to buy the kit than buy components individually. The MC-724 IC serves as an oscillator and amplifier. Two MC-780 are used and serve as dividers which divide by 10. The unit can be calibrated against an electronic counter or against the 15 MHz WWV signal.

The power supply provides a regulated 9 volts using a Motorola MFC 6030 IC regula-

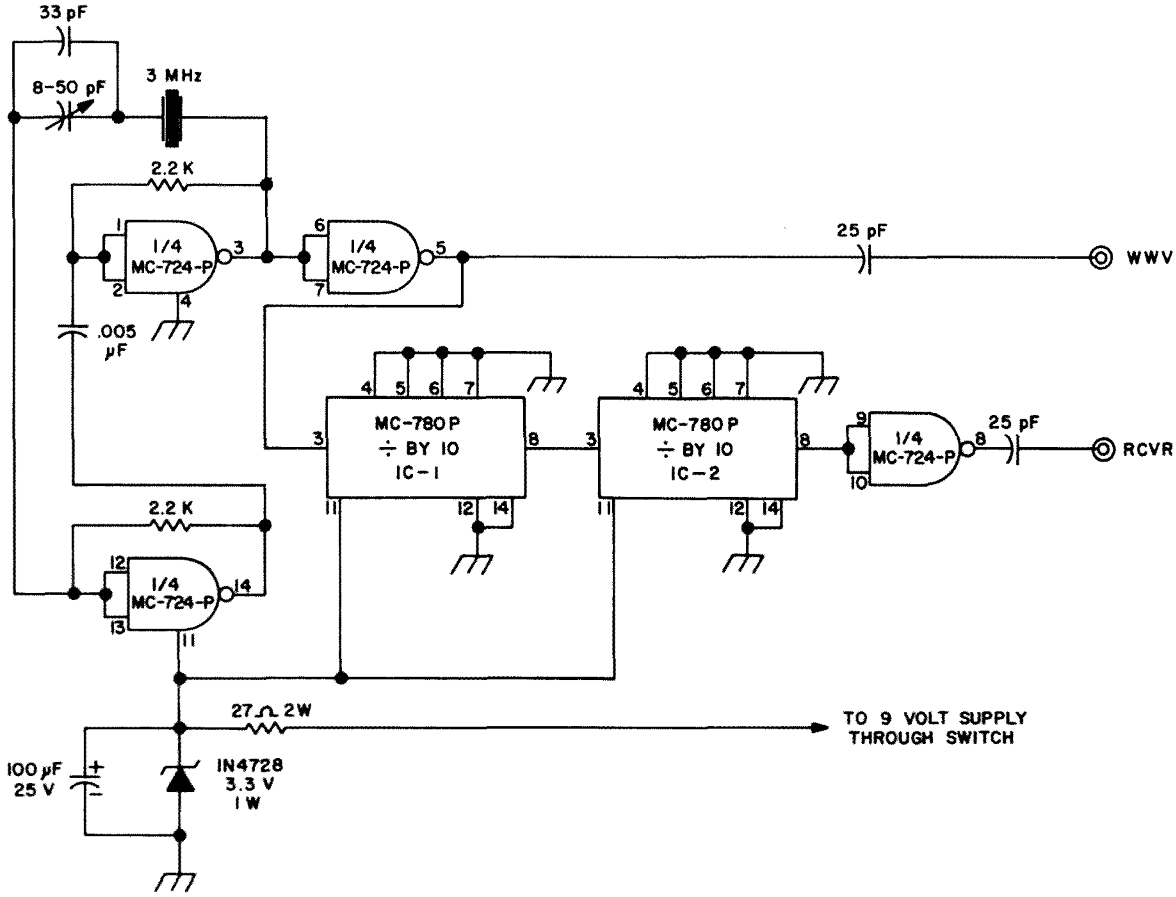
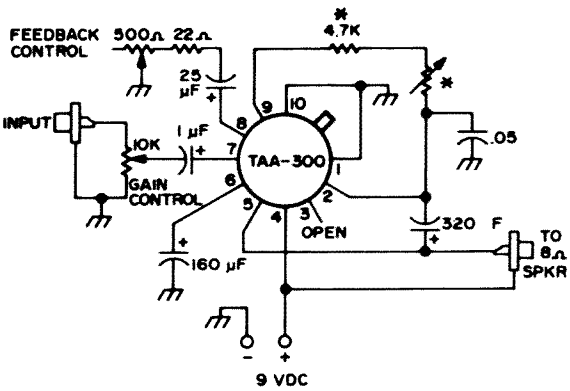


Fig. 3. Crystal calibrator schematic. No P.C. board layout is given but boards are available from the source given in the text.



* CAN USE TOTAL FIXED R OF 6.2K, BUT BETTER TO USE 8K POT. AND SET FOR 8 mA TOTAL CURRENT

Fig. 6a. Schematic of the audio amplifier.

The rf attenuator must have a usable range up to 150 MHz. I used a Jerrold Model A-72 attenuator with the unit to provide up to 82 dB of attenuation. First the signal generator must be calibrated against a known rf source. I found that my four crystals at 6 MHz range varied no more than 10%. Next the crystal oscillator output must be set up for a reference output. Say you choose 70 μV. From the chart in Fig. 5 this corresponds to −70 dBm. Now the rf attenuator can be put in series with the output and set for any value desired. For example, the crystal oscillator is set up for 70 μV, the attenuator is set for 31 dB. From the chart 70 μV corresponds to −70 dBm. If we add 31 we have a signal of −101 dBm. This corresponds to 2 μV. We could use dBw instead of dBm and get the same results. *Note: dBm – is the power in dB relative to 1 milliwatt; dBw – is the power is dB relative to 1 watt.*

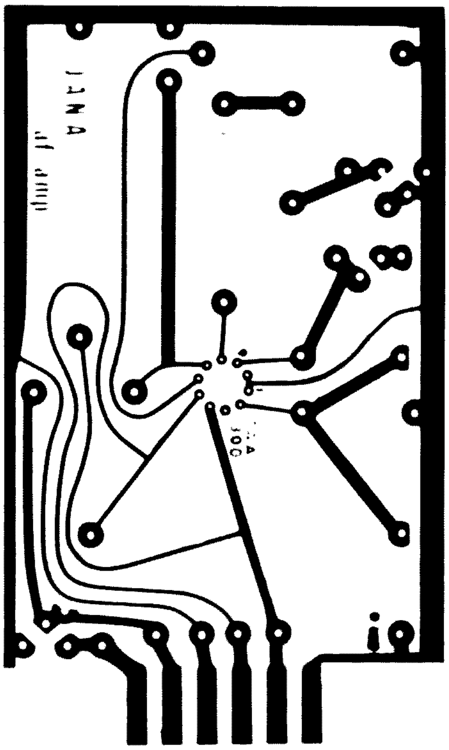
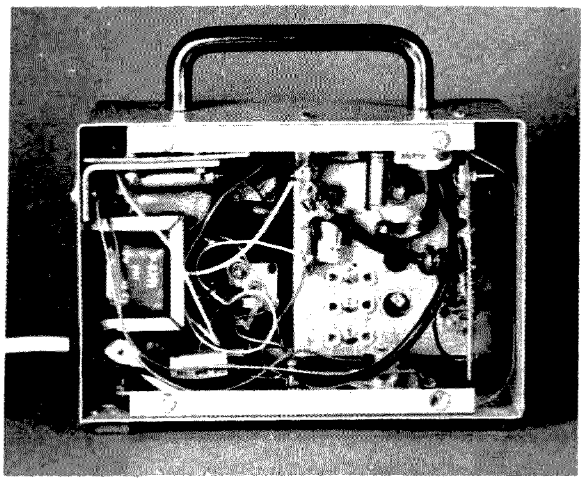


Fig. 6b. Full size audio amplifier P.C. board.



Rear view of the unit showing circuit board placement. The audio amp is mounted along the top at the left with the crystal calibrator next to it at the right. The crystal oscillator circuit board is vertical next to the right wall of the cabinet. The power supply is tucked between the transformer and speaker. Note the subchassis used for mounting the vernier oscillator capacitor and crystal sockets.

Summary

I think you will find this test set very useful for servicing and checking both repeaters and mobiles. It may be desirable to install a nicad battery with charger so the unit becomes truly portable. I have used this test set on some of the commercial frequencies around 160 MHz with excellent results.

...VE7ABK

The P.C. boards are available from *Camgard Supplies Ltd., 2055 Boundary Rd., Vancouver, B.C.* The three available are for the power supply, the crystal oscillator and an audio amplifier. Each board sells for \$2.00. The crystal calibrator board sells for \$4.25 from *Perfection Electronic Products, 404 E. Harrison, Royal Oak MI.* The complete kit is \$19.95.

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DX-MISSING MADE EASY

Winner of the most DX-missed award

As honorary president and lifetime member of the International DX-Missers Club, I was recently asked to speak on the topic of Blowing Rare Ones by a local ham group, and my remarks drew so much comment that I decided to condense them into an article for *73*.

In this way, it is hoped some of the rewards of failing consistently to hook DX stations can be relayed to others of the amateur fraternity who covet the awards, certificates and sense of accomplishment that come to dedicated and skillful hams who sharpen their talents for chasing and missing.

In all modesty and only to display my credentials as an authority on the subject, I cite my logs and my lack of QSL cards to prove I have accumulated over the years a total of 347 countries missed.

Not only that, but on one memorable day last August I racked up a five-band missed-all-continents record within a three-hour period.

And twice I have come within one blow of the real Hat Trick: missing all zones in a single operating stint.

This, I certify, all has been done on a somewhat limited operating schedule, always as a single-operator activity using a multiplier of zero.

Now granted, anybody with talent, patience and a willingness to learn from past mistakes could have accomplished these goals with extreme QRP and a non-radiating antenna.

But, in all cases, my own achievements have been racked up with reasonable power (a quarter-gallon) to a three-element yagi atop a 50 ft. tower, everything peaked for maximum yield, the rotator properly calibrated, and the feedline hooked to the rig.

That's where true skill shows up in results.

I'll touch on one more phase of my attainments to complete my showing of credentials and prove the rewards that flow from sharpening your DX-Missing skills before getting into the here's-how-you-too-can-learn-to-blow-them portion of this verbal seminar.

The proof of the pudding, so far as my abilities in this difficult field are concerned, lies in the awards that have come to me as a consistent misser of rare and common DX.

I am the holder of certificate number one from the How Come Nobody Can Hear You Even When the Band is Open? club of America.

I have on my shack wall the first Outstanding Amateur award ever issued to any U.S. ham by the International Organization of Your Key Clicks are in There But Where's Your Signal?

I own the original, though chipped and fading, ham-of-the-year plaque for 1957 from the A-2 Operator's Club bearing the inscription, "For Outstanding Contributions to the State of the Art of using Tri-Bander Beams as True Non-Radiating Dummy Loads."

And I am expecting almost momentarily the ultimate star for my crown of achievements, the gold-inlaid handkey screwed to

the rear end of a plywood cat, inscribed: "To K9AZG, The Only Active Ham in North America Who Missed San Felix Island, CEØ, While Hanging in There Reasonably On-Frequency with Reasonable Power."

Hunh?

But enough about me. Now about you!

If you have any modicum of talent as a strike-out champion in the ball game of chasing DX, you can improve your latent skills by mastery of a few simple rules.

1. Always zero atop the biggest and best signal in any pileup when calling a new one you intend to miss.

2. If and when that big signal hooks the DX, rezero atop the next loudest caller.

3. When working sideband, set your VOX to trip the rig in at the fifth syllable and to drop out between words.

4. When working CW, double or halve your speed to call slow DX operators with burp-gun rapidity and fast ones at five words per minute.

5. Time your calls to double with the DX for at least a portion of each of his transmissions.

6. On phone, call the DX with whatever accent he is using, exaggerating it as much as your talent at mimicry allows, and giggle a lot.

7. On CW, set your bug or electronic keyer to produce dots and dashes of precisely the same lengths, preferably two bauds each.

8. Call a lot and listen little.

Those, then, are the basic and cardinal rules to learn if you wish your career as a DX-misser to flourish.

There are other tricks, but mainly they are variations or refinements of the essential eight which you can hear on the air any time the bands are open and so emulate for yourself.

One final word, however. Since hams are gentlemen and gentlemanly, it is of course unthinkable that any true amateur would cheat to accomplish his desired goal of winning laurels as a DX-misser.

But there are those short-cut artists – mainly pirates, bachelors and phone men – who do so.

For their benefit, and for those who might be tempted to follow in their footsteps, the following ploys are considered unfair, unethical, uncouth and unscrupulous tactics, and any DX-misser caught or even suspected of employing them is automatically ineligible as an award winner.

It is not cricket to:

1. Call a DX station more than 50kHz off his frequency.

2. Tune up the beam for maximum SWR, minimum gain or poorest front-to-back ratio.

3. Key or modulate the buffer-driver without including the final or turning on the high voltage.

4. Call everything off the back or side of the beam.

5. Call sidebanders on AM or phone DX on CW.

6. Detune the final from resonance or the antenna coupler for minimum energy transfer.

7. Send a string of breaks without signing your call from time to time.

But of course no right-minded ham would do any of these things, rumor to the contrary notwithstanding . . . would he?

. . .K9AZG

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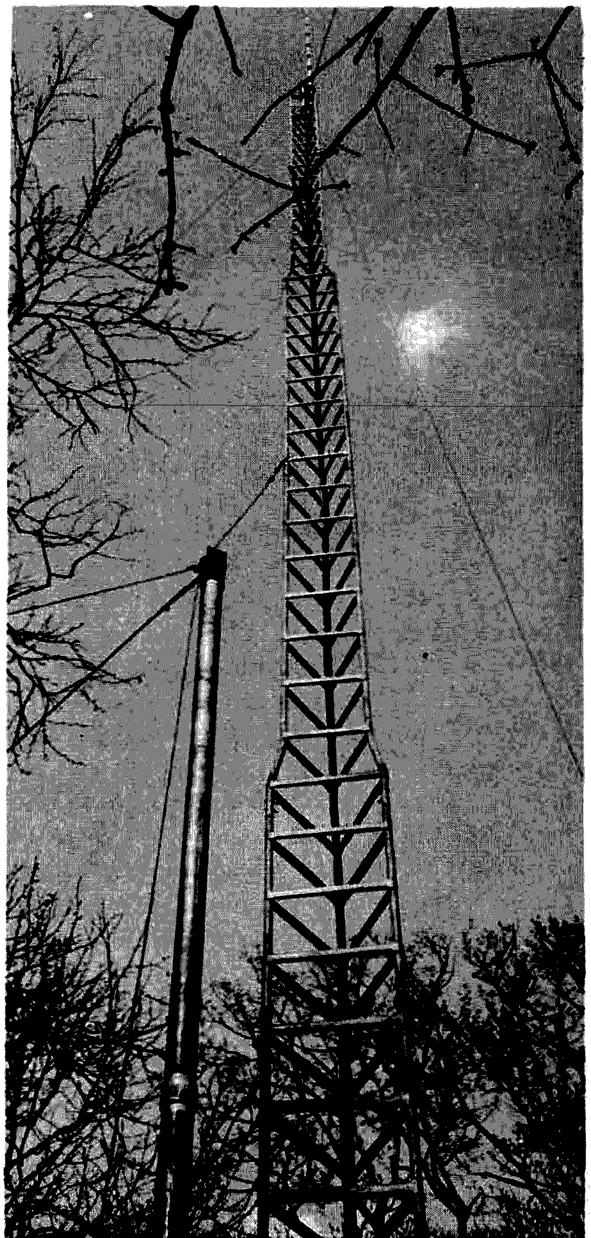
INSTALLATION AND METHOD of TILTING A 60 FT TOWER

This article presents a method of raising and lowering a 60 ft tower with a 21 ft Comm Products omnidirectional antenna on top.

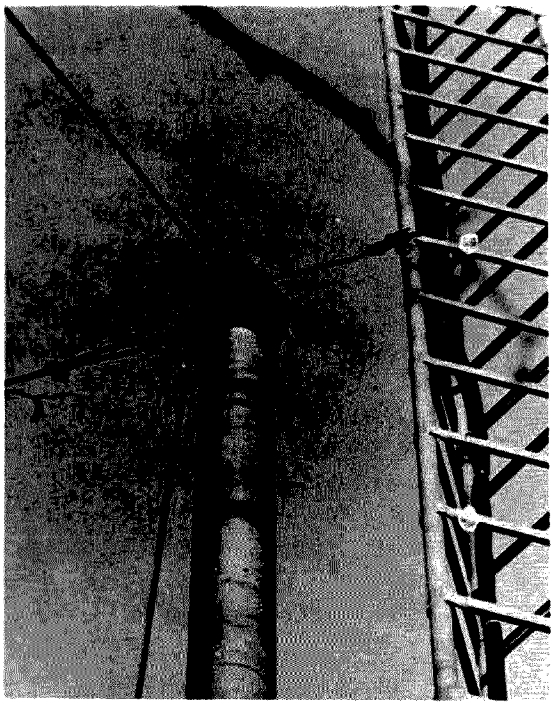
I would like to start out by giving a little background story. I am one of those chickens who think they can climb a tower until I get up to the 20 ft level – then I get what is known as white knuckles. Not realizing this until after I purchased this free-standing 60 ft tower, I was faced with the task of tilting it over or getting a monkey every time I needed antenna work. The tower comes in 10 ft bolt-together sections. I acquired it from a local ham who had a full 20m beam on it completely unguyed for over seven years, which withstood many a good storm. The tower is made by Jontz, which is advertised in all radio master catalogs, dating back at least to 1965. I have the heavy duty model No. 500 which I strongly advise for the service which is about to be described.

I contacted the Jontz Company in order to obtain a new base, as the original one stayed behind inside a block of concrete. During the conversation it was revealed that there is a tilt-over base available to tilt this monster if the proper rigging is used. Hence this article.



Mounting Base

First a hole was dug 3 feet deep by 3 x 4 wide. A wooden frame was built with 2 x 4's level on top of the ground surrounding the hole. This results in a finished job above ground. This frame also helped to support



the tilt-over base during the pouring of concrete.

Rigging Pole

The rigging pole is a permament 4 in. mast which is also embedded in the concrete base. We acquired three sections of 4 in. diameter 10 ft electric conduit with slightly damaged threads. After forcing on two couplings and welding, we had a ridged 30 ft rigging pole. We buried 3 ft in the concrete with 2 ft protruding out the bottom of the concrete into the dirt. This leaves 25 ft standing out of the ground. I believe 3 in. diameter pipe would do the job as well. The raising of this 30 ft pipe was a bit difficult until we had taken advantage of some trees, plus block and tackle. After raising it up and into the hole prior to pouring concrete, we used rope and ground stakes to guy the mast perfectly straight to insure its permanent position. After trueing up the mast and tilt-over base, we proceeded to pour a good concrete mix and allowed two days for it to set before proceeding.

Rigging Pole Pulley

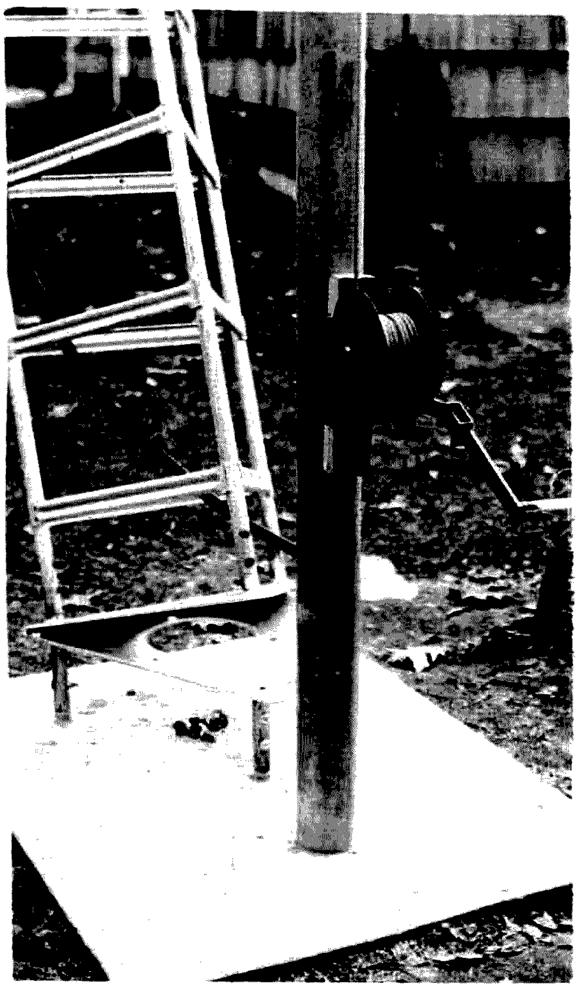
This pulley is mounted on top of the rigging pole to enable a boat winch cable to be routed over the pole via the pulley and act as the pulling point to lower and raise the tower. A steel pulley of good construction is important at this point. I used a steel belt pulley from an old 2 hp motor with a 1 in. shaft diameter. We had taken advantage of one good threaded end of the 4 in. conduit to mount this pulley assembly.

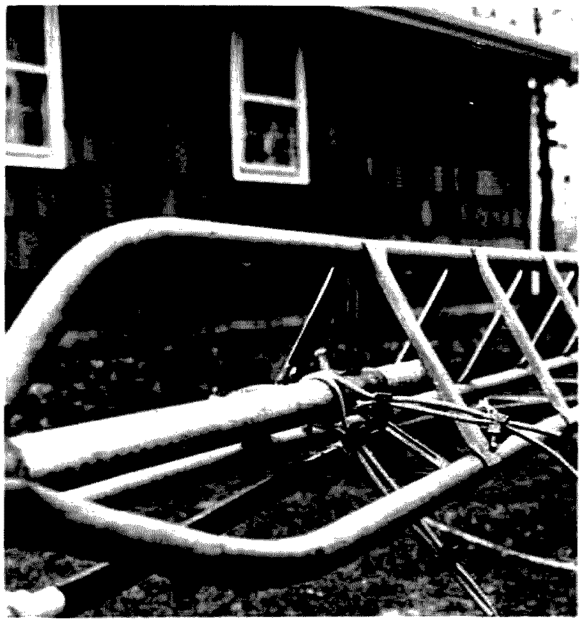
Rigging Pole, Back Guys and Anchors

The anchors are critical along with the guy cable in that if they pull out or the cable breaks, the tower will fall during raising and lowering (enough said). I used 8 ft mushroom anchors similar to the type the lighting company uses for pole guying, but I have to admit they are more than you need. I used two pieces of lighting company guy wire (3/8 in.) which was considered as scrap. This was all secured with two conventional bug nuts at each point of fastening.

Boat Winch

The theory applies here also; if the winch falls apart during lowering, " . . . down will





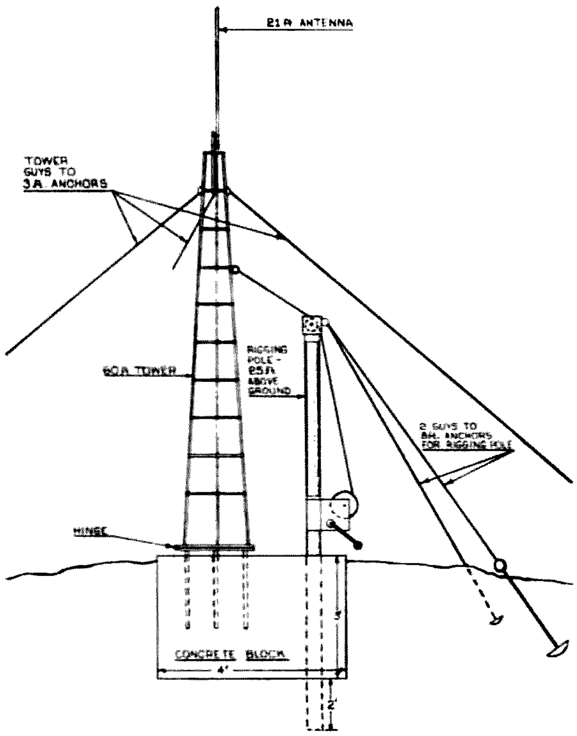
come tower, antenna and all." By canvassing boat yards I received a donation of a rusty boat winch about 3,000 lbs. capacity. After much wire brushing, a coat of paint and replacing the drum shaft with a 3/8 in. stainless steel bolt (stainless steel has a very high shearing point), I felt safe in proceeding to mount same to the rigging pole, again using stainless steel bolts 3/8 in. in diameter. I would like to point out that there are many low priced inadequate boat winches available with pressed tubing for the drum shafts, etc.; be cautious. The same applies to the winch cable – don't scrimp. A typical boat cable is not long enough, so I purchased a 75 ft cable designed to withstand this weight and pull (3/16 in galvanized 7 x 9 stranded vinyl coated, 4200 lbs.).

Tower Guys

Even though this tower is self-supporting after being raised and found to be stable by a tower climber, I felt that my sleep was more important than proving a point, so I decided to put three guys on the very top. I used 3 ft antenna guy anchors and the same cable as described for the winch. Here a lighter gauge cable could be used.

First Raising

With three guys attached to the tower top lying on the ground and all bolts, bug nuts, etc., tightened, I very nervously grabbed the winch handle with two hands and started to



crank. Not realizing a ratio of 6 to 1, I was amazed that it took only minimum effort. As it started to raise higher, I used two hands just in case one decided to quit. With the ratio of the winch it took a while to go up; but indeed it went up and stood there like an 81 ft statue. I locked the winch and bolted the tilt base. The tower was then cautiously climbed with a belt (not by me) to test for stability, which was found to be exceptionally good. Of course the next step was to lower the tower. This worked equally as well as raising. As a matter of fact, the tower went up and down three times that day. The final raising was followed by securing the three guys to the anchors (again, peace of mind).

Conclusion

I would like to make it very clear that I am not a mechanical engineer, nor do I claim to guarantee this safe or foolproof, but it does work. All comments pro or con would be appreciated.

I would like to thank Joe WB2QEB for his original ideas. I would also like to express my deep appreciation to Norm WA2JPZ for his muscle, brains, ingenuity and moral support.

. . .W2ANT

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AMATEUR LICENSING IN JAPAN

It was an article in a late 1971 issue of *QST* that encouraged me to investigate the system of ham licensing in Japan. This particular article said that there were over 230,000 ham licenses there and that Japan would soon overtake the United States as the leader in licenses issued. Why, then, does the *Radio Amateurs' Callbook* list only about 15,000 Japanese tickets?

It's true, now there are almost as many operator licenses in Japan as in the States. But to understand this it is necessary to grasp the excellent system of ham licensing in Japan. The development of this system is a beautiful story of cooperation between a strong, national radio society and government. This has resulted in 4 classes of tickets (see Table for description).

According to information supplied by the Japan Amateur Radio League, ("Data on Amateur Radio in Japan," JARL, Tokyo) hams there got back into active operation in 1952 (following, of course, World War II). There was a slow increase in the number of licenses until 1958. In this year, two new classes of operator license were introduced to supplement the older, general-privilege type First and Second Classes. These two new licenses allowed the holder to operate with a power under ten watts, and on all bands except 14 MHz. One was a Telephone Class (voice only, no code), and one was a Telegraph Class (code only).

The advantage of these tickets is the fact that they are very simple to obtain. To get a First or Second Class operator license, a prospective amateur must be examined by the State at a selected examining point. Unfortunately, these exams are held only twice per year. The Japanese Ministry of Posts and Telecommunications (comparable to FCC) has, however, sanctioned JARL to conduct radio training courses for the Telephone and Telegraph tickets. By completing

DESCRIPTION OF JAPANESE AMATEUR LICENSES

OPERATOR CLASS	SCOPE	No. of LICENSES (1971)
First Class	Service operation and technical operation of radio equipments of amateur radio station. 500W max. antenna power.	2,998
Second Class	Service operation and technical operation of radio equipments of amateur radio station. 100W max. antenna power.	12,237
Telegraph Class	Service operation and technical operation of radio telegraph of amateur radio station using frequencies above 21 MHz, or below 8 MHz. 10W max. antenna power.	21,253
Telephone Class	Service operation and technical operation of radio telephone of ham radio station using frequencies above 21 MHz, or below 8 MHz. 10W max. antenna power.	232,579
	TOTAL	269,067

one of these courses, a student need only apply to the government for his ticket; no exam is necessary.

These courses are held all over Japan. In 1970, 559 such courses were offered and 31,511 new operators were graduated. The students are taught theory and then send for their ticket, bypassing the painstaking wait for examination.

In Japan, operator licenses are obtained first, and then an operator may apply for a station license. All stations must be approved by a government inspector. The League is, however, authorized to certify station equipment (so long as its power is under ten watts), thus eliminating the need for state inspection, and most certainly a painstaking wait.

Perhaps one of the major flaws of our own licensing system is the long waiting period involved. How often have you heard, "I would like to get a ticket but it takes forever and I just don't have the time?" With these government sanctioned courses, the time is quickly reduced and the road is less rocky.

The Telephone license is not a "CB" type ticket, either. People going through the JARL courses are taught radio theory and operating practice; they don't just buy their way in. Since this ticket requires no code exam, operators who might not wish to use code in their operation need not go through the pains of learning it. Again, the code may be stunting our own ham growth.

Price tags are much lower in Japan, ranging from 50¢ (U.S.) for the ten watt operator tickets to $4.20 for a 500 watt station license. Here it may be noted that the maximum antenna power allowed for a station with a First Class operator is 500 watts.

The rapid growth of ham radio in Japan can be credited to an excellent, well organized national society and a willing government. Hopefully, our own system could benefit from the Japanese ways and grow more quickly, too.

The author is indebted to the Japan Amateur Radio League for their aid in supplying information.

. . .WB5EBC

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A SIX METER CONVERTER USING INTERNATIONAL CRYSTAL KITS

The International Crystal Manufacturing Co. is to be congratulated on putting out a series of four little 1½" X 1½" kits with printed circuit boards and all the components needed to make up an excellent six meter converter for a total of onlv $17.40, including the transistors and the local oscillator crystal.

Included are two rf stages, a mixer, and a crystal-controlled oscillator, each only 1½" X 1½" and 1-1/8" high. These are complete down to the last detail of plug-on connectors; they are furnished and each one of them works like a charm. You can assemble and solder any of them in less than an hour and if you pay attention to the precise instructions they work immediately.

You should hear the stations piling in on the completed converter! Even though I am over 50 miles away from the nearest metropolitan area, I counted over one dozen stations talking busily one night as I tuned over the band, which was just as QRM-free as I could wish.

I'm going to assemble these kits, along with the International oscillator into a complete mobile and battery-portable station.

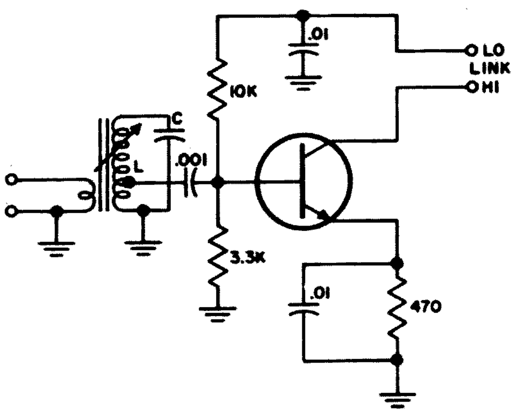

Fig. 1 Schematic of the SAX-1 rf amplifier.

These kits, the two SAX-1 rf amplifiers, the MXX-1 mixer, and the OX oscillator, mounted together in a minibox give you a high-sensitivity six meter converter to put in front of your present receiver.

Don't forget that you're not limited to six. You can order kits and coils for any band between 2.3 and 170 MHz; quite a range. In fact, I'm building a second one for two meters to go into a mobile-battery portable station.

I'm really getting to like these little boards. They do everything that's claimed for them, and look at the prices! A crystal oscillator with the transistor sells, at this writing, for only $2.95, and every last little bolt, nut, and resistor is in that package. You do have to order the crystal separately, but at that price you don't care too much.

The rf Stage

The International SAX-1 kit is a small signal rf amplifier, with the "LO" kit from 3 – 20 MHz and the "HI" kit carrying on up to 150 MHz. It is fine for six meters. The schematic is shown in Fig. 1.

The SAX-1 rf stage went together easily enough; this time I soldered those staked pins right away. When the time comes to test it, one way is through the mixer, so I tackled that kit next. I advise doing the oscillator kit at the same time, then you will have the whole six meter converter to check out.

However, I also tried the SAX-1 kit on the tuned diode receiver for use as an rf amplifier by itself and it showed plenty of gain on six. This gain varied a little with collector tuning, as expected, different lengths of cable used between the rf and mixer stage, or in this test case, to the diode receiver, making a slight increase.

With different voltages and cable lengths I was able to get as much as 40 times gain in power, but I didn't need this much. The noise figure (good in my test) can be set by a nominal 10 dB in the rf stage, which you will get in any case.

The unit handles perfectly and has shown no oscillation at any time. Of course, when I start putting these boards into an enclosure to make a compact front-end converter, some shielding may be needed.

The Mixer

Reading everything in the instruction sheet and checking out the parts, the printed board, and the connections in and out of the board for the rf, the oscillator injection, the dc inputs, and the i-f output, resulted in a good assembly and soldering job in a little over an hour. Like all these kits so far, the mixer worked right away. Figure 2 shows the mixer schematic.

Before I could test the mixer plank I needed another oscillator on 22 MHz to beat with the 50 coming in, to give me an i-f of 28 MHz. It happened that when I started using converters on six and two, my best receiver had a good 10 meter section in it, so most of my converters run with an i-f output of 28 MHz.

In case you wish to operate with a different i-f you can simply order another crystal with your mixer-oscillator kits since the mixer outputs are broad-band. I put in a coil, as shown in one of the possible output circuits in the instruction sheet, since I am

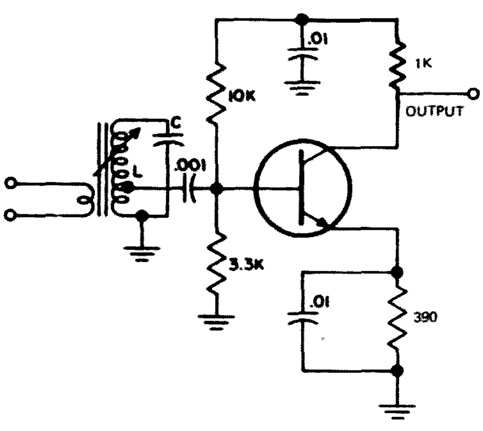

Fig. 2. Schematic of the MXX-1 mixer. Don't forget to use a .001 μF between the output and your receiver.

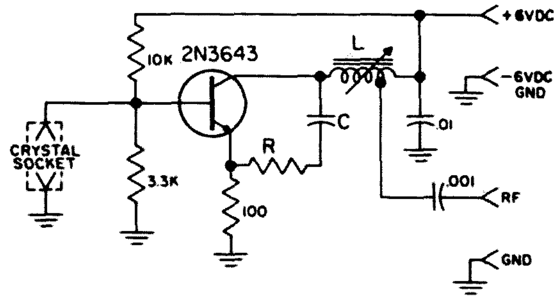

Fig. 3. Schematic of the OX oscillator

partial to tuned mixer outputs. It brought the mixer gain up quite well.

The oscillator is next. Check the section after that for the mixer's tuned circuit output.

The 22 MHz Oscillator

The schematic is shown in Fig. 3.

I was getting to be an "expert" now with International kits. Everything checked out fine, and this one went together as though "factory wired and tested." I got output on 22 MHz as soon as I threw the battery switch. I peaked up the coil correctly with the threaded core slug, which I inserted carefully; it works very tight. This is fine for holding the tuning while mobile, but take the precaution of working the slug back and forth while you're inserting it, the same as with any tapping operation.

All you have left to go for the front end is to connect everything up, watch out for feedback (I didn't find any) through the battery wires back to the input section, and build the tuneable i-f to go with it. I checked it out with my solid state Ameco R5 receiver as a tuneable i-f strip.

The whole converter can be tested out for 28 MHz output with a tuned diode receiver following it for a second method of checking.

Going directly into a sharp-tuning ten meter receiver can be done, but requires care in lining up the converter. After all, it's nice to know that the front end does put out a good 28 – 30 MHz signal you can see on a meter even before you connect the receiver to it.

Tuned Mixer Output Circuit

On page 3 of the mixer instruction sheet are shown several block diagrams featuring

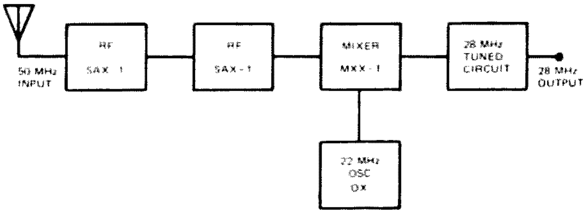

Fig. 4. Block diagram of the six meter converter.

assemblies of mixer and oscillator; and last, the rf stage, mixer, oscillator and receiver. My advice is to use the last mentioned assembly plus the mixer output tuned circuit. This really peaks things up and drops i-f leakage almost out of sight. I-f leakage occurs when you pick up an unwanted signal directly on the i-f frequency with your receiver. The importance of getting rid of i-f leakage is very great. Two things will do this for you. First, plenty of signal from the converter, which simply overrides the leakage signals; secondly, good shielding and inter-unit grounds. Figure 4 shows the complete converter assembly used here.

Your ten meter receiver is now loaded with 28 MHz noise-plus signal. That's good because it swamps out most of the i-f leakage.

The tuned mixer output circuit deserves a word or two more from the point of view of bandwidth adjustment. The signal power it puts into the receiver being used has already been mentioned, and the frequency band over which it does this can be adjusted in width as follows. Figure 5 shows the circuit of this little "peaker-upper." I've always tuned my mixer outputs; a comparison with tuning and without on this converter shows why. Use good shielding and good cables throughout to keep the i-f leakage down.

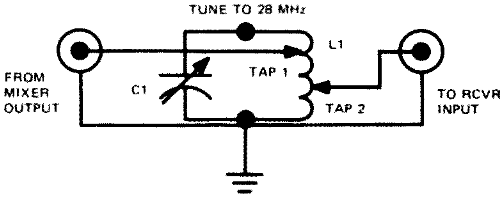

Fig. 5. Tuned circuit used with mixer output stage. L1, 7T no. 18, 5/8 in. dia., 4 TPI; Tap at 3 turns from ground; Tap 2 at 1 turn from ground; C1, ARCO 426, 35 to 275 pF.

Tap 1 adjusts the impedance match of the mixer collector on 28 MHz to L1 and tap 2 adjusts the output loading. I used a tap at 3 turns for the collector and a tap at one turn for the receiver. This latter may vary with the receiver used.

Second rf Stage

This one really topped off the whole enterprise. It is my opinion (subject to further checking) that 99% of the possible birdies, the spurious harmonic detection, and the i-f leakage are eliminated with use of this stage. The increased six meter signals now swamp out any unwanted out-of-band signals.

One of these days I'm really going to lash up a "TRF" receiver! Maybe five or six rf stages. Actually two good ones are probably all you need, because by then you have practically eliminated problems of gain, sensitivity, noise, image, and other spurious reception from your design, leaving only the questions of frequency tuning, dial calibration, and selectivity for your i-f section. These are generally taken care of in your communications receiver.

Frequency Correspondence

This worked out very well using one of the OX oscillator kits and plugging in 50, 50.5, 51, and 52 MHz crystals that just happened to be lying around the shack. I checked on the receiver, and sure enough, at 28, 28.5, 29, and 30 MHz there were the signals, converted down from six meters. This of course is the whole idea to get from six meters down to where you can tune it in on a reasonable cost receiver, on ten meters, for example. However, it is nice to see it spread out right in front of you, and, too, this gives you some idea of the in-band frequencies you tune in with your receiver. As I type, I can hear many signals on six, including some SSB on the low end of the band.

When the two meter converter is assembled and wired I'll need a four MHz band on the receiver, but that's where an all-frequency receiver, 0.5 to 54 MHz comes in handy. If you have an amateur band-only job you can use different crystals in the converter to tune over a wider band than is available in such a rig.

Harmonic Detection

This is a very nasty thing to enounter. It has discouraged many an amateur builder as well as old pros. You're tuning nicely over the band when suddenly you come upon the most awful racket you've ever heard. One of your oscillator harmonics, times two, three, or four, from 22 MHz up to 44, 66, and 84 and even higher landed on a TV or FM station. One of those "fifty thousand watts by Authorization of the FCC's jobs." You're using a narrow band AM dectector and these FM signals do not sound nice at all.

They also come in loud on a few inches of wire or components exposed on the bench. The answer is shielding and more rf stages, luckily enough the same cure used for i-f leakage.

Listening on Six With a Complete Converter

I braced up a wide-spaced four element beam only about three feet over the ridge pole and immediately was listening to several lads chatting away. This was noon and mind you, a Wednesday. Rotating the beam and hitting myself on the head for neglecting this band for several years, I heard over a dozen stations in the eastern New England area some 75 miles south of Peterborough NH. A 90% QRM-free band with MHz width!

My main lab receiver is an all solid state job tuning from 0.5 – 54 MHz, as mentioned, for only $89, the Ameco R5. It is doing a good job with this International converter just finished, considering the compromises that must be made in the receiver in order to tune such a range. As well as listening to the first six amateur bands while I write and work it is extremely useful for various things in the lab, such as listening to oscillators you may be building anywhere up to and including 54 MHz. And now of course I'm using it as a tuneable i-f for the International converter on six, and soon for two also.

At 7:30 to 8 A.M. several mobiles were coming in from Sudbury, Wayland and Framingham, MA, to name a few towns heard from 50 airline miles plus. These signals come right over Temple Mountain, a 2000 foot ridge in my backyard.

. . .K1CLL

J. D. Lamonica XYL W7DXX/1

THE WIFE, THE HAM, AND THE OTHER WOMAN

The wife was happy and so was the groom
At least 'til the end of the honeymoon.
Then, alas and alack! Oh, pity the wife
She discovered another in her husband's life.
When home from work he'd rush through the house
To hear the words from her squawking mouth.
Alone in his shack with her he'll sit
As long as his sleepy eyes will permit.
His meals are prepared on a TV tray
Which the wife sets down, then tiptoes away.
She must not disturb with whisper or sigh
The other woman and her avid guy.
From family gatherings he'll usually abstain
With explanations weak and lame.
Friends and relatives feel put down
When he retreats to his sacred ground.
Many nights on bended knee
The wife thanks heaven for color TV.
Her husband has said: "What I am, I am"
And heaven help her – the nut is a ham.

My husband one day showed me an article in *73* that was reprinted from an Ann Landers column. A wife had written to complain about her husband's interest in ham radio. Ann Landers responded with something to the effect that a woman who could not get her man away from a piece of machinery did not have much imagination. Have I got news for her. Racquel Welch in the nude wouldn't interest my husband when he is engrossed in his conversations with those people who have only call letters and no faces.

Most wives of hams probably fight the eternal triangle of husband, wife, and the radio, but my husband happens to operate a remote on top of a 9000 foot mountain. Whenever he has to check his radio it takes all day, and I am required to sit at home so I can give him test counts. Some of my most frustrating moments have been, when in the middle of a project I could not put down, like changing a baby's diaper, I'd hear a voice saying "Honey, if you copy me now give me a ten count." To ignore him would only mean he'd think he wasn't getting through. That would mean he'd spend more time on the mountain in 15 feet of snow working on something he didn't really have to. Frankly, I'm beginning to live with the idea that "Big Brother" is watching me. My husband's control unit for the remote fits neatly in a closet in our master bedroom. How many other wives have been awakened at 3:00 in the morning by a strange voice asking "Anybody copy through the W7DXX repeater?" A couple of days ago I found him staring at a map of the world. "What are you looking for?:: I asked. "Oh," he said, "I was just refreshing my memory on the exact height and location on Mt. Everest." . . . . . I fainted.

Jacqueline D. Lamonica

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TUNABLE AUDIO FILTER

Like to build an audio filter for your receiver that will give you a substantial reduction in heterodyne and noise interference? The unit is intended to be connected between the speaker output of a receiver and the operator headphones, the insertion loss of the filter being enough to drop the normal speaker output power to a comfortable headphone level. The filter consists of two sections directly connected together as shown in Fig. 1. The first is a 500–2000 Hz bandpass filter to reduce the audio bandwidth to that required for human speech, and its response is shown in Fig. 2A. The second

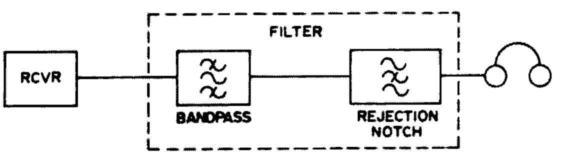

Fig. 1. Block diagram of filter.

section is a very effective tunable notch filter that will tune out any unwanted continuous tone such as a heterodyne. It tunes from 350 to 6000 Hz and its response is shown in Fig. 2B.

Figure 2C shows the overall response of the two sections. The notch can of course be moved in or out of the passband. The resulting hole in the audio response has little effect on speech, and if no heterodyne is present, it can be usefully adjusted to produce some improvement on certain signals.

Details

Figure 3 shows the complete circuit diagram. The bandpass filter is a straightforward type consisting of constant-k low-pass pi and high-pass tee sections. This arrangement uses the least number of inductors and also produces steadily increasing attenuation outside the passband. The tunable notch circuit uses a Wien bridge arrangement. Figure 4A illustrates the basic operation of this circuit. At a frequency given by $f = 1/2\pi CR$ the impedance of the parallel CR combination, let this be Z, is half that of the series CR combination, as shown in Fig. 4B. Since the other resistors are in the same ratio, the bridge is balanced and no signals at this frequency are heard in the headphones. At all other frequencies the bridge is unbalanced and signals are heard. By making resistors R ganged and variable, the bridge can be tuned to reject any desired frequency.

The circuit diagram shows a 1 kΩ

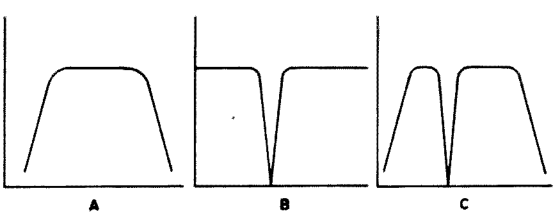

Fig. 2. Bandpass response of filter sections.

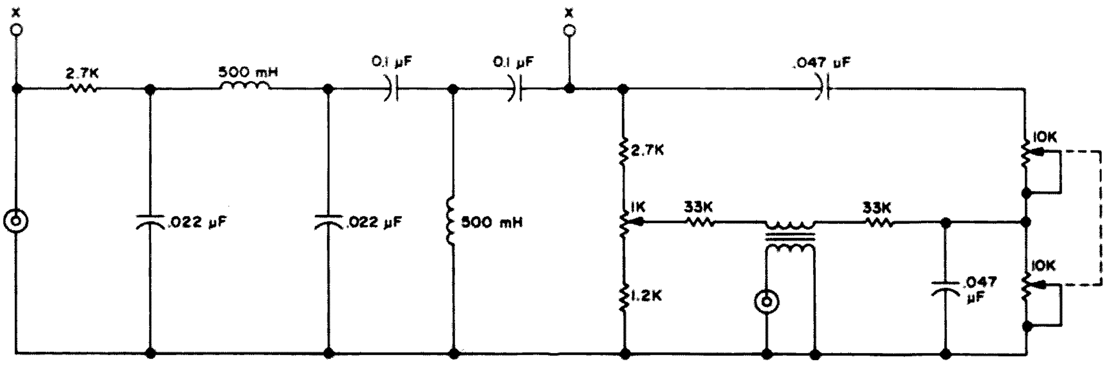

Fig. 3. Filter circuit diagram.

potentiometer. This is a "fine" balance control to allow for differences in the values of the 0.047 µF capacitors and errors in the tracking of the ganged potentiometer. In practice, this control needs little adjustment. The output goes via resistors and a transformer to the headphones. Two resistors are used to balance the winding capacitance of the transformer to ground, which would otherwise lessen the sharpness of the rejection notch.

Construction and Operation

The construction is quite straightforward except that because of the sharp notch an epicyclic drive to the ganged potentiometer is essential. The 1 kΩ potentiometer just needs a small knob. The stray capacitance around the Wien bridge components should be reduced as much as possible and the wiring to the 33 kΩ resistors kept short. The whole unit can be mounted in a minibox.

Before finally screwing the lid down, check that the headphone level is satisfactory. If not, change the value of the 33 kΩ resistors accordingly, keeping them both the same. To get some idea of the effectiveness of this filter, tune in an AM station with the receiver bfo on; then carefully adjust both the controls until the heterodyne disappears.

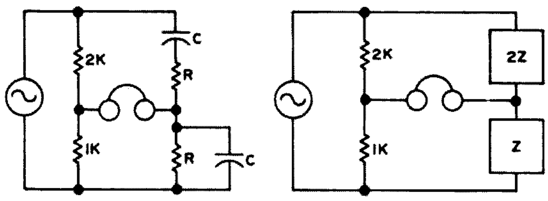

Fig. 4. A&B. Wien bridge arrangement as used in filter.

Alternatives

The classic tunable rejection notch circuit is the parallel tee. However, although it does not need a balancing transformer, it does need a three-ganged potentiometer, and its notch is not quite as sharp as the Wien bridge arrangement. Therefore, I considered the Wien bridge arrangement to be a more practical solution.

An alternative inductorless bandpass filter is shown in Fig. 5. This had a bandwidth of 200–5000 Hz, but the shape is not quite as ideal. It is quite effective, though; and if used, it should be inserted at points X in the circuit of Fig. 3.

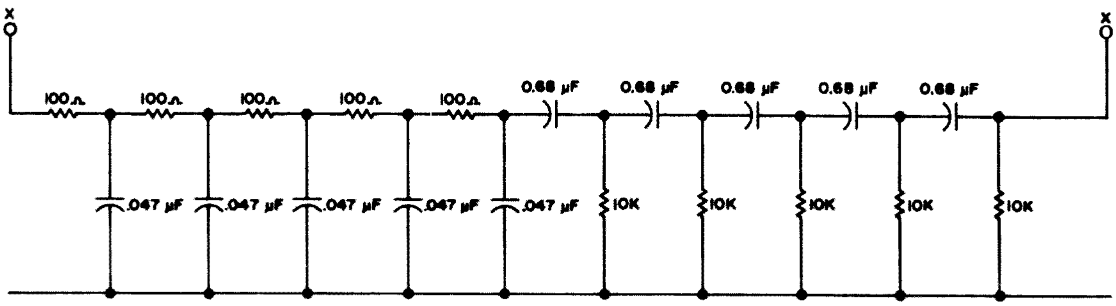

Fig. 5. Alternate bandpass filter.

. . .G8ABR

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SIX BAND LINEAR (AT 5¢ PER WATT)

There is a misconception floating around that homebrew equipment must look that way. To me this is a lot of baloney. I say that homebrew equipment can look as good as you want it to, and I'm sure many builders will go along with me on this. A little time and effort in the construction of homebrew gear can and does pay great dividends in the amount of satisfaction received in operating a rig you built from scratch. Some fellows have never realized this pleasure, and in a way it's a pity. (I had better get off my soapbox and get down to the real purpose of this article.)

In the following pages you will read about a linear amplifier that may convert you from an appliance operator to an avid homebrewer. I'll try to present the material in such a way as to give the inexperienced builder a chance to *become* experienced, and the experienced builder the opportunity to become a even more competent.

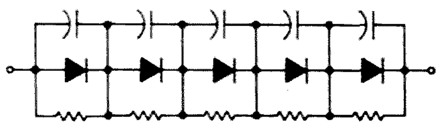
The amplifier is basic and complete. I will go over each section and cover it to the best of my ability. The general circuitry of the amplifier is pretty standard and science will not be shaken by any new circuit discoveries. However, the purpose of the article is to present the standard circuit in such a way that we can approach our junk boxes instead of our pocketbooks. By the way, I might mention that the linear cost me $50 complete. This figures out to about 5¢ a watt. Not a bad investment. Although I did quite a bit of scrounging from my junk box and that of my friends, I am certain that the average builder can come pretty close to my price if he has a reasonble junk box or friends with junk boxes, or both. Preferably both.

I hope I have enough of you fired up now, so let's get down to business.

General Layout

Before I go on, I should explain that the linear uses four 811A's in grounded grid and runs at an input of about 1000W PEP. The 811A's are a fairly common tube and no trouble should be encountered in locating a few. The linear is housed in a DX 100 cabinet. This cabinet provides lots of room for the bigger surplus parts I used. The builder may want to cut down on the size for some reason. With a little planning in layout, this can be done.

DETAILED DRAWING OF D1 AND D2



RESISTORS 470K 1/2 WATT
CAPACITORS .0047 MFD 1000V CERAMIC
DIODES 1000 PIV 1 AMP

D1 IS IDENTICAL TO D2

Fig. 1. Series diode bank used in the power supply.

The first rule in the homebrewing game is to scrounge a lot. I can't overemphasize this fact. Ask around for a part you need. More times than none you'll find a fellow glad to give away a piece of junk that you are tickled pink to get your hands on. One example of this is the cabinet and chassis I used in the linear. They were both ideal for my purpose and neither cost me a cent. These two pieces of equipment obtained free offer a great savings on the total cost of the linear.

The Power Supply

It is good practice when building to design each section with a higher breakdown rating than will ever be encountered through normal use. By designing something with this in mind, you can be sure that the circuit will probably outlive you.

The diode bank that I used is shown in Fig. 1. The bank is good for 5000V at 1A. Some rating, isn't it? The following is an explanation of why and how I made the diode bank so husky. First, I used a voltage doubling circuit. This meant I needed two diodes at the very least. Because I wanted a rugged diode bank, I used five 1000V 1A diodes in series to form one bank of the doubling circuit. I did the same for the other bank and wound up with a board containing 10 diodes, 10 resistors, and 10 capacitors. The resistors and capacitors are shunted across the diode to prevent harmful spikes that could zap a diode. Some of you may be dubious about using 10 high voltage diodes. Have no fear. The diodes are relatively inexpensive and can be purchased cheaply from Poly Paks. All components are mounted on a phenolic terminal board.

Now that we understand the construction of the diode bank, let's backtrack a little to the ac end of the power supply. The ac cord runs into a preventive device called a brute force filter. The purpose of the filter is to block any rf from backing up through the ac power lines. This is an inexpensive precaution against interference, the number one enemy of ham radio. The coils are made out of #16 enamled wire and wound on a round form about ¼ in. in diamater. They are close wound for about 1½ in. Two of these coils are wound and placed between two terminal strips. The coils are placed in the ac line and any rf is bypassed to ground through the four capacitors. The number of turns of the coil or its diameter are not critical. This flexibility of the construction adds to the filter's simplicity.

From the filter, the ac passes through a fuse and a switch on its way to the transformers. I used two different transformers for the following reason: Each filament of the 811A'S draws 4A. Since we are using four of them, we have a total current drain of 16A. Since most power transformers do not carry that heavy a 6V winding, I scrounged up a surplus transformer rated at 20A. Not only was it perfect for the 811A's, but it was free (another example of scrounging). The other transformer I used was an old TV-type that can be dug up by anyone taking the time.

As stated before, the power is routed through a switch. I used two switches, one for the filaments and the fan, the other for high voltage. The ac switch allows current to flow through the primary of the filament transformer while none flows through the high voltage transformer. By throwing the high voltage switch, the current is routed through the primary of the high voltage transformer. This is a safe way to turn the B+ on and off while the filaments stay lit. As an added precaution, it can be seen in the schematic that the high voltage will not be turned on unless the filament switch is thrown. This prevents high voltage from being applied to a cold tube.

To get the high voltage I needed out of a 900V transformer meant I had to use a circuit that boosted the voltage up. This is why I used a full-wave voltage doubler. I have already explained the diode bank, so

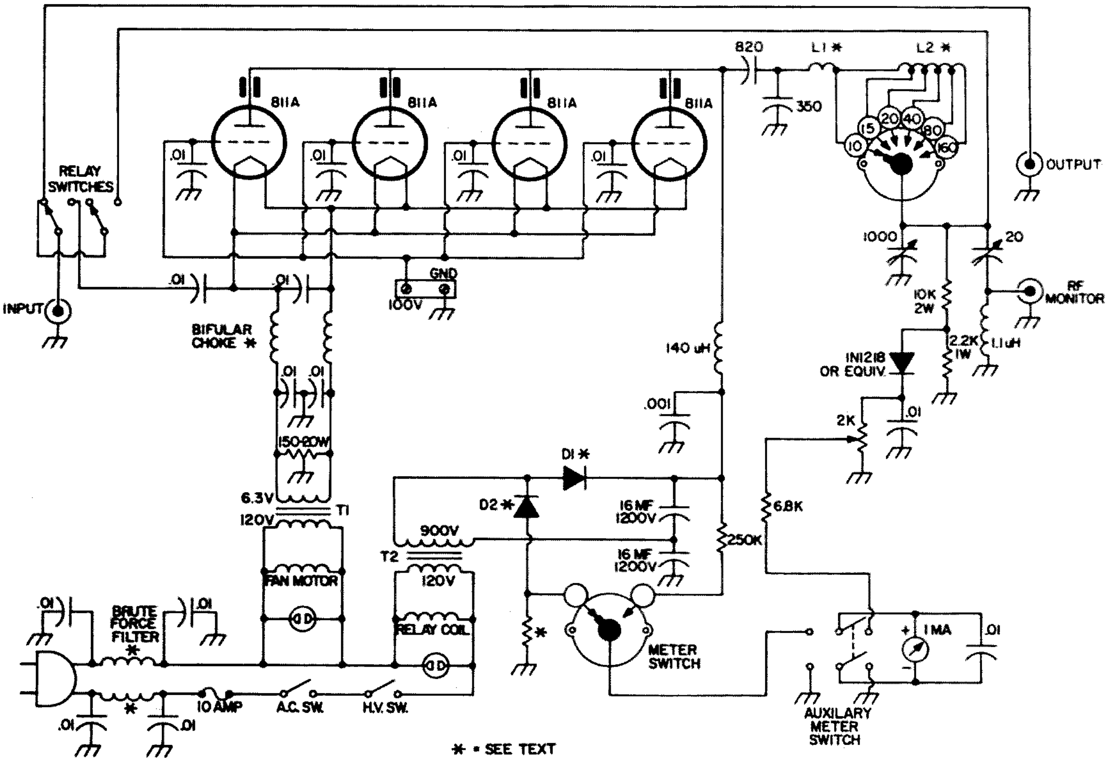


Fig. 2. Schematic diagram of the linear amplifier and power supply.

now I will explain the filtering action. The outout of the diode bank is fed to two surplus oil capacitors. These are located on the extreme right end of the chassis. These capacitors are rated at 1200V with 16 μF capacity. By placing the two capacitors in series I had a safe breakdown rating for the filter.

The filtered no-load dc output of the supply is about 2200V. During operation the voltage drops down to about 1400V. The reason for this big drop is the size of the capacitors. If the builder wishes, higher capacity computer-grade capacitors could be installed and a little better regulation would be realized. I might mention that the oils have worked well for me and they should continue that way for a long time.

It must be remembered that the ac lines in your circuit are going to carry the current of the entire unit. Use the proper wire. Don't try to get by with a smaller size; it will work for a while, but you want something that will work forever. Another word of caution – *lethal voltages exist in your power supply*. Use your God-given brains at all times. You won't be given a second chance.

After you finish the power supply, you have almost half the linear done. Now you can move on to the rf circuits.

The Input Circuit

I'll begin the explanation of the input circuit with a description of the bifilar choke. The choke is wound on a ferrite core measuring about 5½ in. in length and about ½ in. in diameter. Although I feel that the choke is larger than would be needed, it works out well. You may want to refer to the September 1967 issue of *73* for a detailed description and explanation of designing bifilar chokes. This article will tell you how to figure what length of coil you will need. I suggest that it be read thoroughly before the construction of the choke. The windings are made of #12 wire. Remember that the full 16A in the filament line are flowing through this wire. All I can say is, the heavier the better. Two equal lenghs of wire are cut and wound side by side around the ferrite. If you did a good job and used heavy enough wire, the windings will cling to the ferrite and you will have one solid unit that could be used in a battleship.

One last word on the choke. Don't bother buying one. You can do it for less than a dollar, and if you already have a ferrite core lying around, you can do it for nothing. Besides, it's fun.

Looking at the schematic, you will see that I have a 150Ω 20W resistor shunted across the filament winding. You will also see that the tap is grounded. I did this because the transformer that I dug up did not have a centertap. So I figured the next best thing was to make my own. The grounded slider serves as a return point. Without it the linear will not function.

You will notice on the schematic that the input first goes to a relay switch. The purpose of the relay is to enable the operator to switch the linear in and out of the circuit. This device comes in handy, and I recommend that it be installed in this linear for reasons of convenience. The relay is activated by the high voltage switch. In this way, the operator can transmit with low power while the filaments are heating up and instantly have high power by flipping the high voltage switch. A word should be mentioned here about the relay itself. Since the relay (DPDT) will be on as long as the high voltage is on, you must use a continuous duty relay. The relay contacts must also be heavy duty. The relay I used cost me about $4.50 and had contacts rated at 12A. Although I bought this relay new, you may be able to find one in your junk box and thus knock five bucks off the total cost of the linear. The operation of the relay is as follows: The input rf is fed to the middle arm of the relay. With the high voltage off, the power is fed directly to the output jack. When the relay is activated, the input rf is fed to the filaments and the output jack is connected to the linear's tank circuit. Instant power.

Although the grid circuit is technically not a part of the input circuit, I'll explain it here. Each grid lead is bypassed for rf by a .01 capacitor. The leads are also bound together at a central point and run to one screw terminal located on the rear of the linear. The other terminal is grounded. When in use, a jumper is connected between the two screws, thus grounding the grids. However, when the linear is idling, −100V (available off the back of most exciters) is fed to the grids, making them cut the tubes off. Thus during idling no great amount of current is being drawn by the tubes. The −100V is usually controlled by a relay in the exciter and this relay automatically grounds the grids of the tubes during transmit.

The Tubes

As stated previously, the tubes used in this linear are 811A's. The builder may choose to use a different type of tube that he has on hand. This is well and good providing he takes everything into consideration – such as the power supply, input circuits, and tank circuits. Since I was not certain as to whether or not I would ever change the type of tube used in the linear, I constructed the tube layout in a somewhat novel way. I took a 5 x 8 sheet of steel and mounted all four tubes symmetrically on it. I mounted the choke in the center of the four tubes, giving me one solid unit of four tubes. I then cut a 5 x 8 hole in the chassis and had a place to mount the tube plate. The tube plate lies flat against the chassis and it is barely noticeable that the tubes are mounted on the plate. The purpose of mounting the tubes in this manner is simple. Suppose I want to run two 572B's instead of my 811A's. All I have to do is make a separate plate and pop it in the old hole. It makes for easy modification because the rest of the linear can remain the same. This little feature can prevent a great headache for the ham who likes to experiment with different tubes. The tubes are placed a reasonable distance apart, as common sense dictates.

Although I could probably get away without cooling the tubes, I feel the little extra effort is worth the dollars saved in extra tube life. I used a cheap but effective ac fan for the cooling action. This fan is activated when the filaments are turned on. The fan, although small, circulates the air around the tubes just enough to prolong tube lfe. The fan is mounted on an angle and the main stream of air flows toward the center of the tubes. The fan is quiet and one must really listen for it in order to hear it. I paid a dollar for the fan I used. There are many available on the surplus market for about that price.

The leads from the plate caps are brought together at the top of the rf choke. This choke acts as a terminal point for the leads. The leads are covered with ferrite beads for the purpose of parasitic suppression. The beads provided me with better results than could be obtained with the old coil-resistor combination. The B+ line is bypassed for rf by a .001 3 KV ceramic capacitor which is mounted at the extreme bottom of the rf choke. From here, I used Beldon #7766 high-voltage wire for the connection between the choke and the power supply.

The Tank Circuit

I incorporated a conventional PI network in the tank circuit. The B+ is blocked by a 820 μF 20 KV doorknob capacitor mounted just before the tuning capacitor. The value of this capacitor is not critical, but the voltage rating must be high. From this capacitor the rf is fed to the tuning capacitor. The capacitor I used was a Johnson 154-2-98. The capacity of the unit is approximately 350 pF. I obtained the capacitor surplus for about $5. Again if the builder can dig one up he can save himself another five bucks. The output capacitor was one I had found in the shack, and heaven knows where it came from. It is a three section job with all the sections paralleled to give me about 1000 pF of capacity.

The 10 meter coil (L_1) is made from copper tubing. The coil consists of three turns wound on a 2 in. diameter form. The form is of course removed after the coil is wound. L_2 is made from two pieces of coil stock that I found in a friend's junk box. The coils were soldered together and a sheet of Lucite was cemented across the diameter to make a solid coil 3 in. long and about 4 in. diameter. This Lucite provides extra support as well as a means of mounting the coil. The coil is mounted upright for the purpose of space saving.

The rf switch must be heavy duty to withstand the rf voltages present in the tank circuit. The switch I used came out of an old army TU-7-B tuning unit. I purchased the unit for about $3. So far the only thing I used out of it is the switch, but there are many goodies inside worth saving.

Many of you may be asking the natural question of where to tap the coil for each band. The answer is simple. Beg, borrow, or steal a grid dip meter with a reasonable accuracy. Start with 10 meters and work down. Adjust the input and output capacitors so that they are half meshed. Insert the grid dip coil into L_1 and tap down on the coil until a dip is noticed. You now have 10 meters set. Now move to 15 and so forth all the way to 160. The taps are brought out to the switch. It should be mentioned here that the GDO should be set to the middle of the band being tuned.

Since the only effective way of knowing whether or not you are flat topping is to see it on a scope, I incorporated a scope monitoring circuit. The circuit forms a capacitance divider network to which the vertical deflection plates of an oscilloscope may be connected. By increasing the capacitance of the 20 pF variable, you effectively increase the level of signal going to the oscilloscope. The circuit is very handy for monitoring purposes.

Metering

In my linear I have one meter perform three different duties for me. It reads plate voltage, plate current and relative output. Looking at the schematic, you may wonder why I used two meter switches. I had a small wafer switch available in my junk box. The switch contained four contacts. Since it was very possible with this switch to make contact with two points simultaneously, I thought it necessary to space the current and voltage positions one contact apart. This left me no room for the relative output position. I then installed a toggle switch which either connects the meter to the regular meter switch or to the rf monitoring circuit. All this circuit does is sample a little rf by rectifying it and feeding it to the meter. The 2K pot is used as a sensitivity control and is mounted on the front panel to the left of the meter. The circuit is useful during tuneup as an output indicator.

A detailed explanation of how to determine meter shunts and series resistances is given in most handbooks. They will provide you with all you need to know about meter circuits and should be consulted before any attempt is made to design your meter circuit.

The Final Touches

Up to this point you've had it pretty easy. Whatever mistakes you made will not be noticed from the outside. Now you are faced with the tricky and delicate part. Your main objective is to make your homebrew equipment look professional. The outside of the linear is what is going to strike people's eyes. It is from appearance that most people draw opinions.

Let's start with the basic front panel. First, remove the front panel so as to make it easier to work with. Give it a good washing and roughen the surface a little with fine sandpaper. The reason for roughing it is to give the paint a better surface to adhere to. Once you have it cleaned and roughened, apply the first coat of primer. I find that paint in a spray can allows for a neater job. Let the first coat dry thoroughly before applying the second coat. You can get by with two coats of primer, but if you want to play it safe, a third coat should be applied. After letting the undercoating dry for a day, apply the first coat of finish. The color is your own choice, but dark gray looks great. Allow it to dry and apply a few more coats. Now you have a clean, neat looking panel to work with.

The next step is to apply the lettering for the equipment. Before you start lettering, make sure you know what you want and where you want it. After the decals are dry, you have little chance to change your mind. Once you know where everything goes, your next step is to square things off. Draw guide lines in pencil to help get the decals straight. The lines can be easily rubbed off when the decals are dry. Don't skip this step of squaring because you'll be sorry in the end. After you have the lines drawn you can begin setting the decals. Find the term you need and cut it out as close to the lettering as possible. After you have the decal on the panel, adjust it so the letters are even with the guide lines. Continue applying decals until finished.

Stand back now and take a look at the panel. You'll be surprised at what a good job you have done. A word of advice: Practice before you perform the real McCoy. Practice will allow you to get the feeling of the decals.

Operating

Operating this linear can be considered a pleasure. If you have tuned other linears in your ham career you will have no trouble with this one. If this is your first linear, then the following explanation is for you.

As I said before, the best device that can be used in the tuning of the linear is an oscilloscope. I won't go into a description of proper scope patterns, because this is a subject well covered in many handbooks. If you can't possibly obtain an oscilloscope, the next best device is to use common sense. Remember that by over-driving you are flat topping and creating a mess on our bands. The driving power for the four 811A's is about 100W. I drive my linear with an exciter that has an output of about 60W. I do not have to worry about over-driving, but the fellow with the higher power exciter does. If it is not possible to lower the power of your exciter to 100W, then it will be necessary to build an attenuator. These are also discussed in handbooks. Once you have the proper drive, you can tune up the linear just like you tuned up your first novice rig. Start with having the loading capacitor plates fully meshed. Now set your meter to read relative output and adjust the tuning capacitor for maximum output. Continue doing this until key down current is about 600 mA. Remember not to keep the key down for too long a time. You can now switch to whatever mode suits you and have fun. Keep in mind that you should not exceed the dissipation rating of the tubes for too long a period. Treat them well and they'll reward you with long service.

Conclusion

Although I described the linear the way I built it, the industrious homebrewer can and should deviate from the circuit. At any rate, it can be seen that the linear can be built cheaply by using all the surplus parts you can get your hands on. Remember the name of the game – scrounge!

I'll be happy to try to answer any questions on problems that pop up. If you have a problem, do not hesitate to contact me.

...WA9JMY

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CURRENT GAIN IN HIGH POWER NPN SILICON XSTRS

While trying to design a high current power supply regulator, I found that suitable transistors available to the experimenter are few. And these transistors are not cheap; two of the three selected sold for more than $6. Current gain is definitely expensive in more ways than one, as this article exposes.

But more important – of those available, the betas given were either in a range or as a typical value. The disparity was just too great. Having close at hand the facilities to measure accurately transistor current gain, I decided to measure them myself. This short article is a report of my findings.

Beta is Not a Transistor "Constant"

The results are presented in three forms: a table of beta values versus collector current, a picture of an actual curve trace, and the graph of the averaged beta values for each type of transistor versus collector current. All were obtained (directly or indirectly) from a Tektronix 576 curve tracer and all illustrate the same main point; current gain decreases with increasing collector current.

Each representation does have its own specific advantage. The table will also give you some idea of the individual performance you can expect from these readily available transistors. The values given are for h_{fe}; H_{fe} would be larger as seen from the trace. (h_{fe} is small signal current gain; H_{fe} is steady state current gain.) The curve trace shows you how I measured the beta and also allows you to determine the H_{fe} of SK3036 sample number 3. You could expect similar results with other transistors. The graph allows you to easily "see" the beta decrease (and how fast it decreases) as the collector current increases. I do not remember them ever mentioning in school that this would happen!

Conclusion

The point to remember is this: the manufacturer's specifications are probably not applicable to your specific application. If possible, measure the parameters of your

TABLE I
BETA VERSUS COLLECTOR CURRENT

Type	HEP 704		SK3036			HEP S7000		
Typical h_{fe}	90		100			70		
Sample #	1	2	1	2	3	1	2	3
I_c	BETA (h_{fe})							
15 Amps	4	2	8	12	9	11	11	9
12	8	4	12	12	12	16	14	12
10	8	6	14	14	14	20	19	20
8	10	8	18	22	20	22.5	22.5	22
7	18	12	21	20	25	25	25	22
5	22.5	17.5	30	32.5	38	40	35	38
3	40	25	45	55	60	55	45	50
2	56	44	60	72	90	76	58	64
1	90	70	85	105	125	115	70	78
0.5	125	100	100	110	150	115	93	85

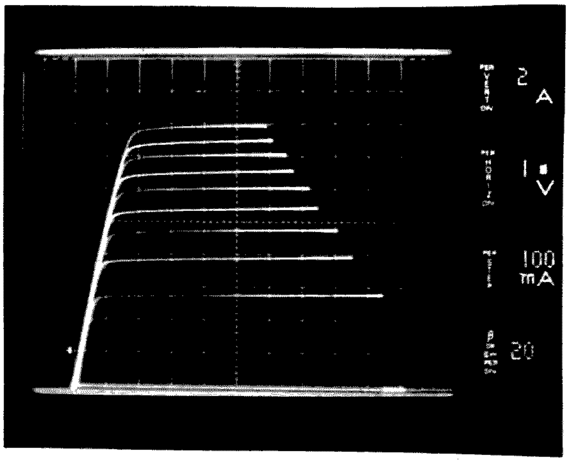

Fig. 1. Curve trace of RCA SK3036 transistor, sample #3.

specific transistor; if not, use the most accurate data you can find.

Obviously I could have extended my observations to other transistors and/or parameters. This is indeed a worthwhile project, but I shall leave it to someone more industrious than I.

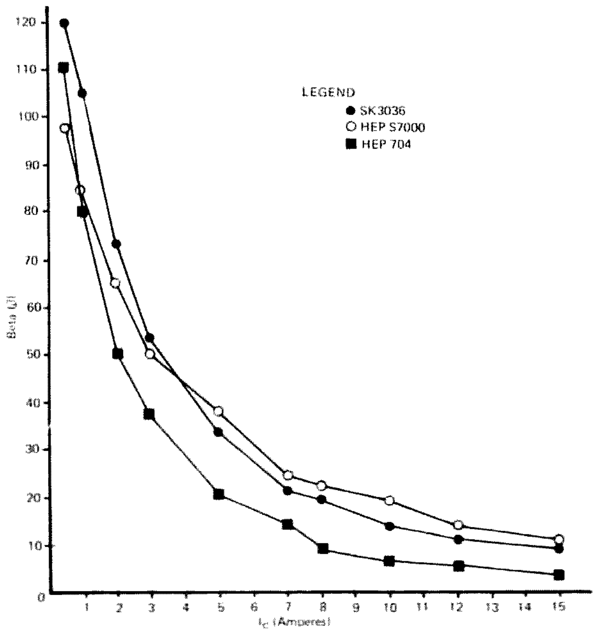

Fig. 2. Averaged beta values versus collector current for all 3 types of transistors.

Acknowledgements

I would like to thank the Department of Electrical and Computer Engineering, Clemson University, and in particular Dr. Lewis T. Fitch W4VRV, without whose help this project could not have been completed.

...WB4LVA

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IC TEN METER TUNER FOR USE WITH SOLID STATE VHF-UHF CONVERTERS

This ten meter front end is highly suitable for use following crystal-controlled converters from six meters up to the 1296 MHz band, or higher. Its mixer output is on 1.65 MHz which places the image 3.3 MHz away, where it is many dB down.

I will describe in detail the design method and circuit of a ten meter tuner using the Motorola HEP590 IC (integrated circuit) in the rf stage for high gain, high selectivity, and no feedback. Also used are the Miller 3-gang miniature variable capacitor and the Miller two-speed dial for proper coverage and easy tuning of the frequencies between 28 and 30 MHz.

As we went through the rf stage, its use as a ten meter preamp by itself proved so excellent that this is also described as a bonus, and will prove to be a very useful piece of equipment at times.

The use of the Motorola HEP590 IC results in high gain, high selectivity by virtue of the loose coupling between stages and tuning elements, and negligible feedback in the rf stage. The reduction of image is thus considerably enhanced over that obtainable with a single transistor.

As a ten meter preamp it adds an almost unbelievable pull-in power to a low cost or old receiver on ten.

Available coil forms and coils are also used, which makes it easier getting components together for construction.

Last but not least, the unit is packaged and ganged using a tracking method which does not consist of just connecting three coils to three sections of a gang capacitor and hoping for the best. With the method described you *will* get proper tracking and be sure of it.

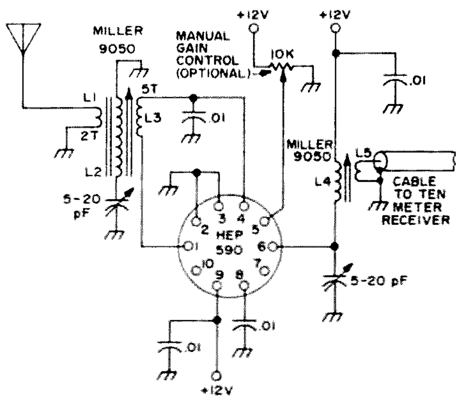

Fig. 1. Pre-amplifier circuit diagram. If manual gain control is not desired, leave pin 5 on ground for maximum gain. Pretty simple, eh?

The result is a battery-operated unit which in conjunction with an i-f system and a VHF or UHF converter, will furnish you with a mobile, portable, or emergency receiver having extreme selectivity and sensitivity, and cut you loose from dependence on your big 50 lb communication receiver and ac power.

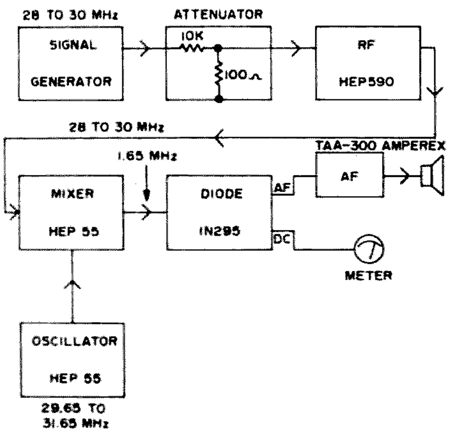

Fig. 2. Setup for coil alignment.

The Motorola IC HEP590 as a ten meter preamp showed its high gain and practically non-existent feedback. To be exact, even with high Q coils in the input and output circuits it has never oscillated even once in use so far, from 135 kHz up to 50 MHz. Having battled with transistor feedback and neutralization for some years, this is really something. The 590 even handles better, tuning much like an old fashioned tube receiver input with symmetrical tuning instead of the unsymmetrical tuning as with the usual transistor rf stage without neutralization.

The schematic of the preamp is shown in Fig. 1, using the Miller subminiature coils in both input and output circuits. In this preamp the 9050 coils are left with their original windings and the extra windings are added over them. For the 2 MHz bandspread tuning range of the complete front end using the three gang capacitor, the original 9050 windings are removed entirely as you will see in Fig. 3.

This preamp, however, gave such a jolt to the present ten meter band on my lab receiver that I thought it best to describe it for you as a separate item. Once again, it features absence of feedback and has never oscillated once, in spite of all kinds of changes and tuning up for ganged operation.

Input to the 590

See Fig. 2, block diagram, and Fig. 3, overall schematic. Table 1 gives you an idea of how to line up an input circuit for ganging use when a tuning range of only 2 MHz is desired with a given capacitor that has a 5–20 pF capacitance range. The block diagram, Fig. 2, shows the coil test setup that enables you to do this with ease and confidence.

As is the case with all the $30 signal generators that I've so far encountered, the attenuator on mine is nothing to write home about, and not enough shielding can be used for the money to do much good at 28 MHz, but you can make up an external uncompensated attenuator that will do the trick for you. This little 100 to 1 box with its 10K in series and the 100Ω in shunt is included in Fig. 2. Of course, attenuators of this sort are really perfect only at dc, but you'll be surprised at what it can do for you at 28 MHz just the same. It *does* give you relative power reduction and that's what you need here. With the signal generator gain about 3/4 on, plug the attenuator box into the "high" output jack and there will be a reasonable output from the HEP590 which will give about a volt or so of dc out of the diode, as in Figs. 2 and 4. The test diode is clipped onto the mixer coil as shown in Fig. 4, and there is of course not much selectivity, but that's not what you're after here. You want relative gain as in Table 2 and relative tuning range with a section of the three-gang tuning capacitor, and this test circuit gives it to you in easy style. Be very sure that nothing is being overloaded as this will falsify your tests. The dc voltage out of the diode should rise to 4 or 5V when pushing the input (do *not* do so) and drop to zero when the coils are detuned. Incidentally, if you plug an antenna into the input you can hear those Texas kilowatts on ten, and up on

Turns on L2, Fig. 3	Relative Volts out	Total Tuning Capacitance
8	2.1	30
7	2.1	35
6	2.1	40
5	2.1	50
4	2.1	70
2	2	85
1½	1.4	110
1	N.G.	N.G.

Table 1. Relative gain vs turns on L2.

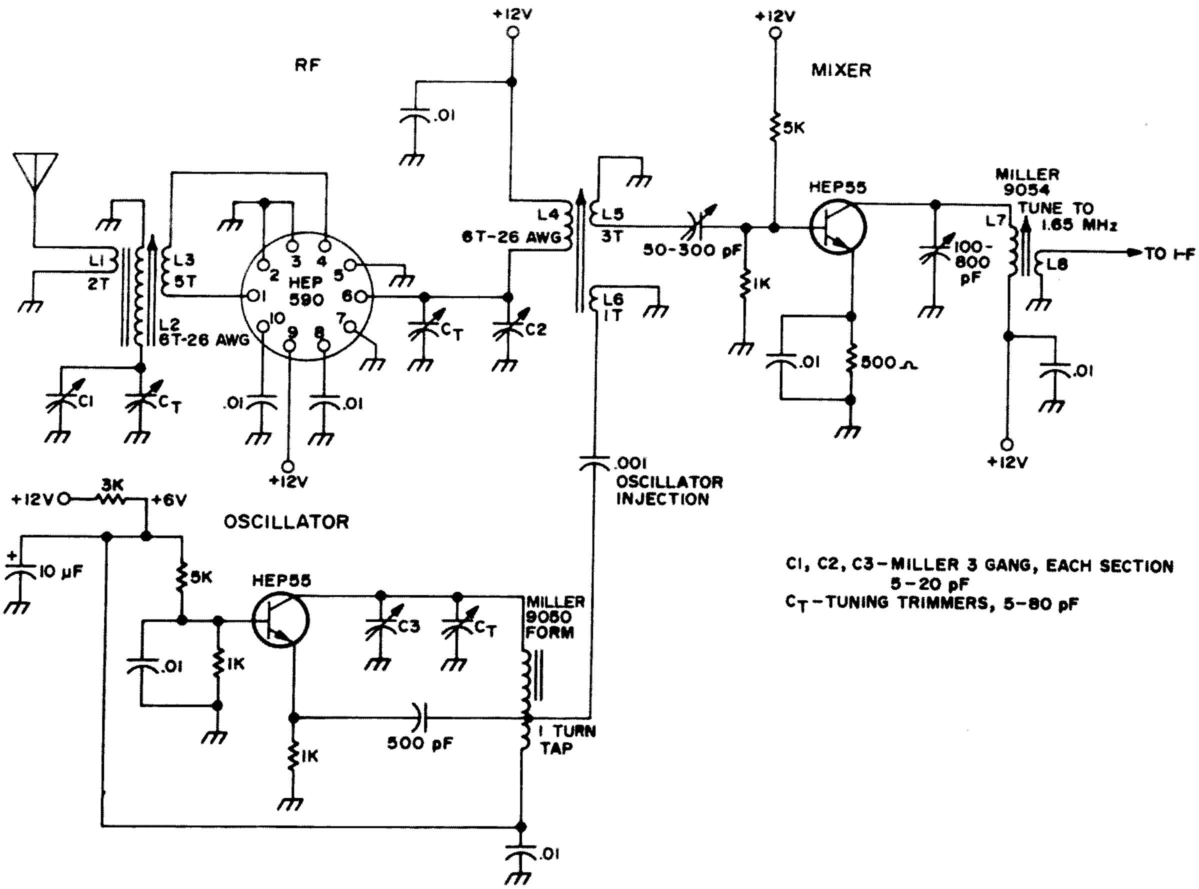

Fig. 3. Ten meter tuner circuit diagram. The Miller 9050 and 9054 should be used if at all possible. They are ideally suited to this project because they are easy to modify and fully magnetically and electrostatically shielded. They are available through most large catalogs or directly from J.W. Miller Co., P.O. Box 5825, Compton CA 90224. For those who cannot get these coils, the 9050 varies from 1.5 to 3.0 μH and the 9054 ranges from 28.0 to 60 μH. Also, the triple ganged capacitor used is non-critical. Do some experimenting until you get something with a maximum capacity of about 11 pF per section.

the 11 meter broadcast band in the morning South Africa, London and others boom in very loud.

Note that this is *without* any i-f at all so far.

Meanwhile, back at Table 2, referring to Fig. 3, you can see at a glance the relation between the number of turns on L4 and the tuning range. This subject is of great importance in making a ganged job and is taken up in further detail in the next section. Proper tuning is always important for selectivity, which also reduces image, and especially for a three-gang capacitor tracking unit, which is difficult enough without putting odd bends in the tracking curves. If you think it's a lot of work to take a three-winding coil in and out of a circuit 8 times to add or subtract one turn each time, you're so right! But it's worth it. I've left the whole front end alone near 29 MHz for several days now and just tune over a 100 kHz or so with the lab receiver on 1.65 MHz as an i-f and G's, W7's, ZS and UC stations have been on the air most of the time. It's really stable and good, even in breadboard form.

Table 1 shows the relation between the number of turns and the gain, or conversion efficiency of the converter. Only when you cut down to less than 4 turns does the gain begin to drop. This allows you to pick the tuning range you want, still using the 5 to 20 pF section of the Miller three-gang job as is.

2 MHz Dial Spread

This ten meter front end, while very interesting on ten, is primarily designed for use as a tunable converter and i-f unit

between a crystal-controlled VHF or UHF converter and a fixed tuned i-f. This latter should be a double-frequency job for maximum selectivity and image rejection.

The Miller three-gang tuning capacitor, part no. 1460, is such a nice little item that I never had the heart to remove plates on it to cut down the tuning range. There also seems to be a big advantage in the heavy external capacitor padding used in parallel to spread the 3-gang tuning to a little over 2 MHz. Table 2 shows the relation of the number of turns on L2 to the tuning range obtained for the rf input circuit in the ten meter band. Refer to Fig. 1 and Fig. 3. Note that 8 turns gives over 4 MHz tuning range, which is more than wanted. Five turns, plus about 30 pF of parallel pad results in some 2.5 MHz of tuning range on the dial, which gives you a little margin at each end. You can cut this down to exactly 2 MHz if you wish, Table 2 showing that only 4 turns for L2 gives you *less* than 2 MHz of range.

For calibration, a 28 MHz crystal oscil-

Turns on L4, Fig. 3	Relative Output Volts	Tuning Range With 5–20 pF
8	2.3	More than 4
7	2.3	More than 3
6	2.4	About 3
5	2.4	2.5
4	2.3	1.5 MHz

Table 2. Tuning range vs turns on L4 of Fig. 3.

lator can spot 50, 144, and 432 on the dial for you. For example, with a 50.5 MHz rock, doubling several times to 404 MHz as a local oscillator in the 432 receiver, the 28 MHz point on ten and the 432 point on 432 came out on about the same black line, which is plenty good enough. If you want this unit to serve on 6, from 50 to 52 MHz, or on 432, it works fine with its 2 MHz spread. If you are on 2 you may want to cover 146 to 148 MHz as well as 144 to 146, and then you will have to switch crystals in the 2-meter converter. Or build a second one of these jobs that covers 4 MHz spread on the dial. The second one will be easier than the first!

On 432 at present you only need a few hundred kHz spread, but this may change with the years. Right now the 432 band seems to be rock-ribbed, but if a lot more lads get on with all-solid-state rigs and want the continuation of QRM-free QSO's that now exist, they might get to need vfo's. I wouldn't worry about it for a while though.

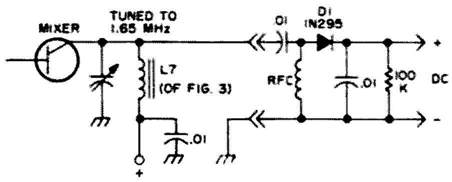

Fig. 4. Diode test plank circuit.

The tuning on even 432 is very smooth and easy with this system, and with the sharp 3–4 kHz bandwidth of the double frequency i-f described, it still remains so. And this is what you need on 432. I remember my first work on 432 with sharp i-f, when turning on or off the kitchen stove three floors below detuned the receiver oscillator out of the passband. Of course that was using those old-fashioned things called tubes! I don't deny that if you're on the car battery and turn headlights on and off, that this won't happen then also with this unit.

Lining Up

Once the combination of L, Cpad, the Cv (variable) has been determined for the bandspread desired to put 2 MHz over 90% of the dial, the business of setting up the mixer and oscillator proceeded. Each Miller 9050 coil form was stripped of its original winding and wound with the number of turns as in Fig. 3 and its coil table, and carefully tested, still using the setup of Fig. 2, the block diagram. With everything falling into line nicely, a preponderance of one turn coupling links could be seen, indicating good match and energy transfer, as well as a smooth frequency curve vs. 3-gang capacitor shaft rotation.

The oscillator took most of the time to line up, but once the main points were found, the rest was easy. The emitter tap works well at one turn from the low end of the oscillator collector coil and the mixer injection voltage is best when taken off the same tap, thus eliminating the need for a

third winding on the oscillator coil. A 3K resistor can also be seen in the plus lead to the oscillator, because the conversion efficiency of the mixer likes it that way, with 5–6V only on the oscillator. This also cuts down oscillator harmonics.

The tuning range of the mixer input inductance, which is also the rf (IC 590) collector coil, is shown in Table 2. The number of turns for best gain is also the same, as you can see in Table 1, which is partly the result of design and partly good luck, I'll admit.

Lask Check Before Ganging

What a pleasure after the tuneup battle! Each of the three circuits, rf, mixer, and oscillator, are now exactly as they will be in the packaged minibox version, each one lively, sharp tuning, with the 5–20 pF of the gang job tuning just over 2 mHz, in parallel with some 60 pF of padding, each dial marked with (temporarily) "28" and "30" MHz. So far not a trace of spurious or birdies anywhere. That heavy parallel capacity really does a job on harmonics. There apparently is quite a benefit with solid state devices in using low-impedance circuits, highly padded and loaded with C.

On The Air

As usual, when I check on ten, the first station heard was an African, CR6JTT, in Angola, Portuguese West Africa. It was 7:30 AM, EST, which might be the reason. ZS6DAL was next. What a time for DX! These lads are just beginning to come through and are still calling CQ! Others heard were UP2KNC, UC5DF, YO6ALD (where in the world is that?), and Uncle Charlie 2KNU. Looking back to my own "best time" on ten, I find it was 1947, which by a strange coincidence turns out to be almost an exact number of two sunspot cycles. I ran a pair of 4-250's and a rotary 16-element beam. If this keeps up I'll find myself on ten again!

. . . K1CLL

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A DIFFERENT METHOD OF QUAD CONSTRUCTION

The cubical quad antenna has long been popular among hams because of its inexpensiveness, excellent performance and light weight. However it suffers from two major drawbacks – it is cumbersome and not very rugged. The design described reduces these deficiences and even further reduces the quad's weight and perhaps expense.

The mechanical structure of the cubical quad serves to support two square forms of wire a short distance apart. The traditional method of construction (Fig. 1) is not particularly efficient, particularly as large torques are impressed on the boom and mast, leading to lack of rigidity, mechanical failure, etc. The design presented here (Fig. 2) overcomes these deleterious forces to a large degree. A quick examination shows the merits of the latter. First, it uses less support material, thereby reducing weight, wind loading, and stress on the mast. Second, the center of mass of each side of the antenna is much closer to the mast, resulting in reduced torque in the center of the antenna, which might otherwise cause it to break. The electrical specifications are in every way identical with those of the traditional quad, and any of one's preferred techniques for constructing a regular quad can be used for this one, except of course for the fact that metal cannot be used for the arms.

...WB2HYW

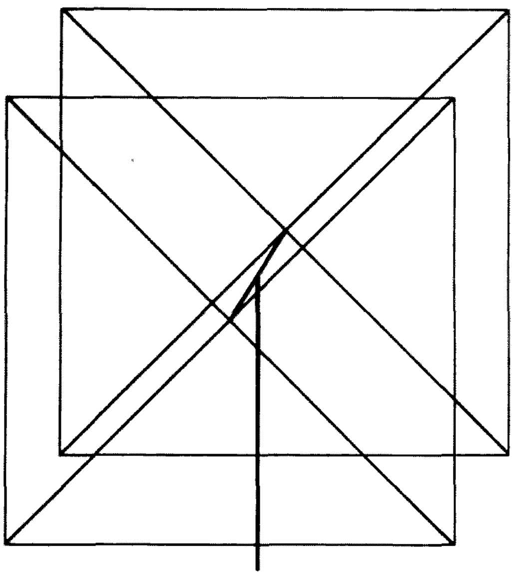

Fig. 1.

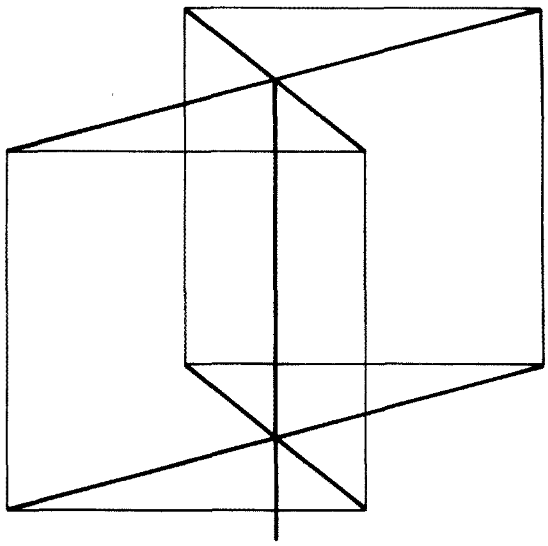

Fig. 2.

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IMPROVING THE DRAKE R4A RECEIVER

The Drake R4A receiver is an excellent piece of equipment as it is, but a few minutes with a soldering iron will give even better operational performance.

The modifications that follow will not affect the resale value of the unit at all and no realignment or instruments are needed. Before you start be sure you have located the right parts; these parts can be changed or added without touching anything else.

In early production runs of the R4A the resistors R41 and R89 were respectively 470Ω and 270Ω. These resistors are in the S-meter circuit and control the activity of the S-meter. Apparently performance could be improved and some changes were made. R41 was changed to 560Ω and R89 was changed to 470Ω. After that there still seemed to be room for more improvement and changes were made by Drake once more; R41 was changed to 820Ω and R89 was changed to 560Ω. However, the last change could cause the S-meter zero pot (R42) to run out of range. The final modification is as follows: change R41 to 820Ω and change R89 to 620Ω.

I mention all the resistance values in case your R4A has different values yes, R41 and R89 are under the chassis on one of the small circuit boards. The numerical designation of the 2 resistors in the R4A diagram has not been changed and a good look will show what is what.

The above modification will make the S-meter performance much better and more realistic, and the following modification, my own, will improve the performance and output of the crystal calibrator.

As it is the output of the crystal calibrator does not give much (if any) indication on the higher bands; on 10 meters it is very weak, certainly no indication of any signal can be seen with the early S-meter circuits. A simple diode will bring it up 3 to 5 S-meter units on the higher bands. Connect in series with C118 (1½ pF) and between C118 and the antenna input jack a 1N34A diode. Lifting C118 from the antenna jack and soldering the diode in series will do it. Just make sure the cathode of the 1N34A is connected to C118 and the anode to the antenna jack; if they are connected incorrectly no or only slight improvement will be noted. No cross modulation effects were observed, since with the calibrator switched off the diode is, for all practical purposes, out of the antenna circuit.

. . .V36TW

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ANOTHER HEDGE CLIPPER

That detector and AGC system you read about in *73 Magazine* has just been installed. You switch on and sit back. The signals pour forth loud and clear. Just then the XYL switches on the vacuum cleaner. The AGC meter goes wild and nothing but grating noises issue from the loudspeaker. You are left with nothing but regrets that you left out the noise limiter as you hurriedly reach for the reference books, only to find such a complexity of limiters that you start tearing what remains of your hair in despair. But hold it! Save that precious commodity on top.

What you need is a noise limiter that is simple, effective, easy to install and will work effectively with any receiver.

Let's take a look at our noisy signal just after detection. The noise clings fairly and squarely on top of both the negative and positive half pulses of audio signal. A circuit is then required which will conduct sufficiently to allow that precious signal through, but will not conduct to the noise riding on top of the audio signals. This circuit must also perform this function on both the negative and positive half cycles of the required signal.

A well known tube circuit which performs these functions is the Dickert noise limiter. However, I had no incliniation to fit yet another tube to an already crowded receiver chassis, and decided to try the circuit with crystal diodes. The circuit eventually evolved as shown in Fig. 1.

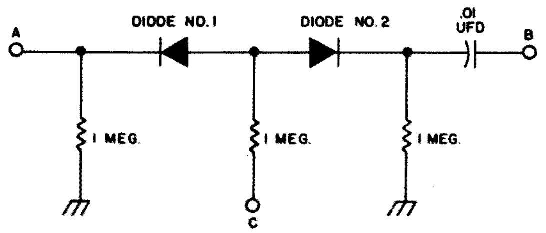

Fig. 1. Crystal diode noise limiter circuit.

The positive voltage, applied through the 1 MΩ resistor to the junction of the two diodes, will hold the diodes in a conductive state. The positive voltage is of such a value that the maximum peak of the audio signal will not reach a value in excess of the positive gating voltage, and will thus pass through to the next amplifier stage.

Now let's see what happens to that large noise pulse riding in on the positive half cycle of our audio signal. On the positive half cycle, the noise pulse will be greater positively than the gate voltage. Therefore, the junction of the diodes is negative with respect to the detector side of the diode, resulting in the No. 1 diode ceasing to conduct; thus blocking the noise pulse.

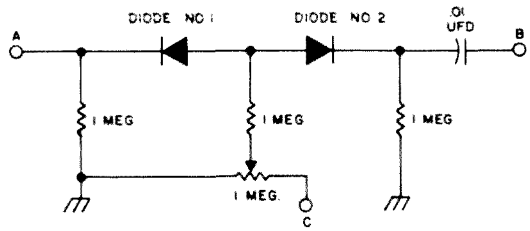

Fig. 2. Addition of 1 MΩ potentiometer to allow the gating voltage to be varied.

On the negative half cycle, the reverse holds true, and then No. 1 diode will pass through the noise pulse. The negative pulse voltage will cancel out the gating positive voltage and thus block No. 2 diode during the duration of the noise pulse. In effect, therefore, the noise pulses riding in on our audio signals are blocked off, both negatively and positively, and our audio rides through. All this with 2 diodes, 1 condenser and 3 resistors. Diodes with a reasonably high back resistance are quite suitable. The higher the back resistance the better the noise limiting action.

I take my positive gating voltage from the cathode of the audio output tube, which reads some 5V. The voltage available from this point may not be a suitable value for gating in other receiver types. A recommended addition would then be a 1 MΩ potentiometer to allow the gating voltage to be varied, and connected as shown in Fig. 2. Again the user may wish to use a negative gating voltage. In this case just reverse the two diodes.

I have thought of using the negative gating voltage, as taken from the AGC line. Provided the AGC voltage is of sufficient value to allow the gating effect, this is quite feasible and our system then becomes signal following.

To insert in the circuit, disconnect the lead from the audio side of the blocking condenser from the detector circuit. Point A is then connected to this blocking condenser, and our free wire goes to point B. Point C then goes to our positive (or negative) gating voltage, to whichever supply is used.

This noise limiter has been tried out on various types of noise interference with gratifying results and is now a permanent fixture in the receiver.

. . .EI4R

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DESIGN FOR AN IMPROVED AGC SYTEM FOR CW AND SSB RECEPTION

A receiver capable of employing full agc facilities under all modes of reception is essential for comfortable listening on the amateur and shortwave bands. Many receivers however, employ only a simple agc system that falls short of providing an acceptable performance, particularly when reception of CW and SSB signals is required. Although some excellent papers have been written on the subject of improved agc systems, most of them involve relatively complex circuitry and are designed to be incorporated as a part of a sophisticated receiver design. I, like many other hams, found the need for an agc system giving acceptable performance under all modes of reception that could readily be incorporated in homebrew receivers and transceivers. The system must, however, be uncomplicated by additional agc amplifiers, "hang" gates and multiple controls. To meet this end the circuit to be described was developed; but first some background theory may be in order to show why the conventional simple agc system is inadequate for code and sideband reception.

Figure 1 shows a simple agc system of the type in general use in the less expensive commercial receivers. While this system may give acceptable results on AM signals, it is unsuited to CW and SSB reception because the attack time for the circuit is too slow. For amateur purposes, the attack time of an agc system may be defined as the time taken for the voltage on the agc rail to reach 63% of the maximum value it will attain upon receiving a steady incoming signal. This may be recognized as the familiar "charge" time constant for a resistor-capacitor combination. Similarly, the decay time for an agc circuit may be regarded as the time taken for the agc rail voltage to drop down to 37% of its maximum value after the incoming signal ceases.

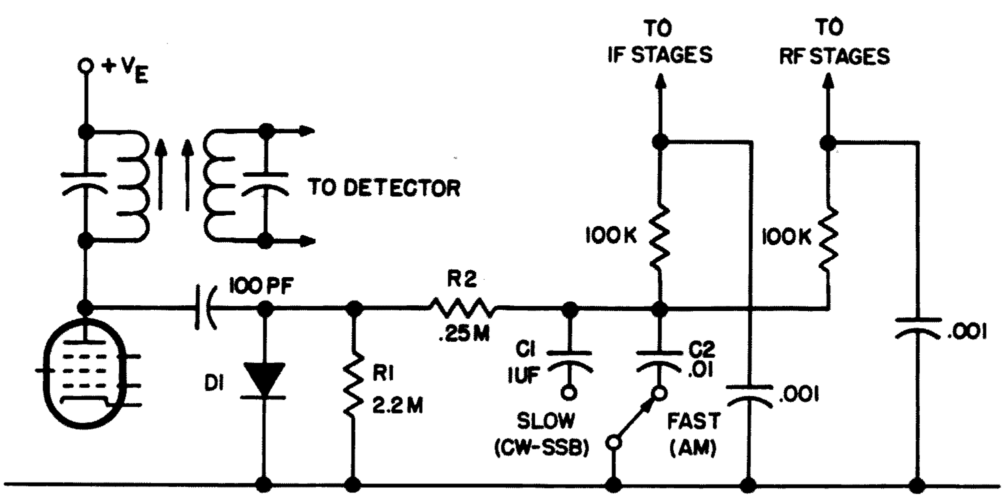

Fig. 1. Typical simple agc system.

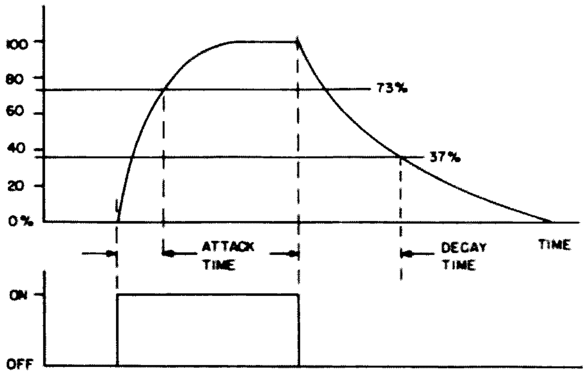

Fig. 2. Relationship between signal level and attack and decay characteristics of an agc system.

These attack and decay times are illustrated in Fig. 2.

When receiving an AM signal, the carrier is present to regulate the receiver gain and the response time of the agc system need only be fast enough to follow signal fading. An attack and decay time of about .15 second is typical for AM reception.

Under CW and SSB conditions, no continuous carrier is present to regulate the receiver gain and if the attack time is too long, an appreciable amount of speech or code may be received before sufficient agc voltage is developed to regulate the receiver gain. This results in an unpleasant "thump" at the beginning of words or code characters. To overcome this effect an attack time of less than .01 second (10 milliseconds) is generally considered the maximum permis-

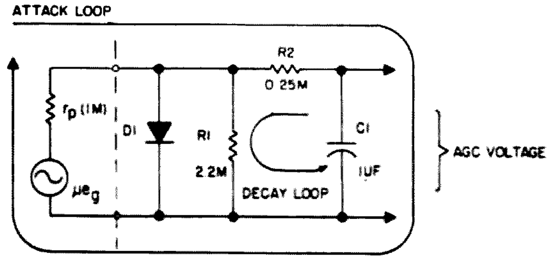

Fig. 3. Calculation of attack and decay characteristics for a simple agc system using an equivalent circuit. Attack time: Refer attack loop. T (seconds) = C (μF) x R (M) where C = C1 = 1 μF and R = Rp + R2 = 1.0M + .25M = 1,25M ∴ T = 1 x 1.25 = 1.25 seconds. Decay time: Refer decay loop. T (seconds) = C (μF) x R (M) where C = C1 = 1 μF and R = R1 and R2 = 2.2M + .25M = 2.65M ∴ T = 1 x 2.45 = 2.45 seconds.

sible for satisfactory results. It is also important that the agc voltage does not fall away too fast between words or code characters, otherwise a peculiar "gasping" effect becomes apparent. A decay time of not less than 1 second will be satisfactory in overcoming this "gasping" effect.

It is common practice to switch a larger value of C in parallel with the agc filter (as shown in Fig. 1) to achieve two rates of decay, one for AM, the other for CW-SSB.

To evaluate the performance of the simple agc system generally, Fig. 1 can be redrawn in the form of an equivalent circuit as shown in Fig. 3.

It can be shown that a valve amplifier may be represented as a voltage generator in series with a resistance that is equal to the internal impedance of the valve. Such representation is known as the "Thevenin equivalent circuit" and is employed in Fig. 3, wherein rp is the internal resistance of the i-f amplifier that feeds the received signal into the agc rectifier circuit. The important feature to note here is that the valve represents a series resistance (rp) whose effect must be taken into account when evaluating the operation of the agc circuit. For a pentode amplifier rp has a typical value of .25 – 1M. By substituting typical values for the circuit components it is easy to assess the charge and discharge loop circuits and hence determine the attack and decay times for this simple agc system as shown in Fig. 3.

It can be seen immediately that the simple agc system falls short of the maximum acceptable attack time of .01 second. The slow attack time can be attributed to the large amount of series resistance in the agc charging path and is made up of the high internal resistance of the i-f amplifier stage and the agc filter resistors. The agc filter resistor (R2) can be replaced by a diode which "gates" the agc rectified voltage into the agc rail thus eliminating its .25M resistance from the circuit as shown in Fig. 4. However the high internal impedance of the i-f amplifier still severely limits the attack time.

An Improved Agc system

To speed up the agc attack time, the limiting effect of rp must obviously be

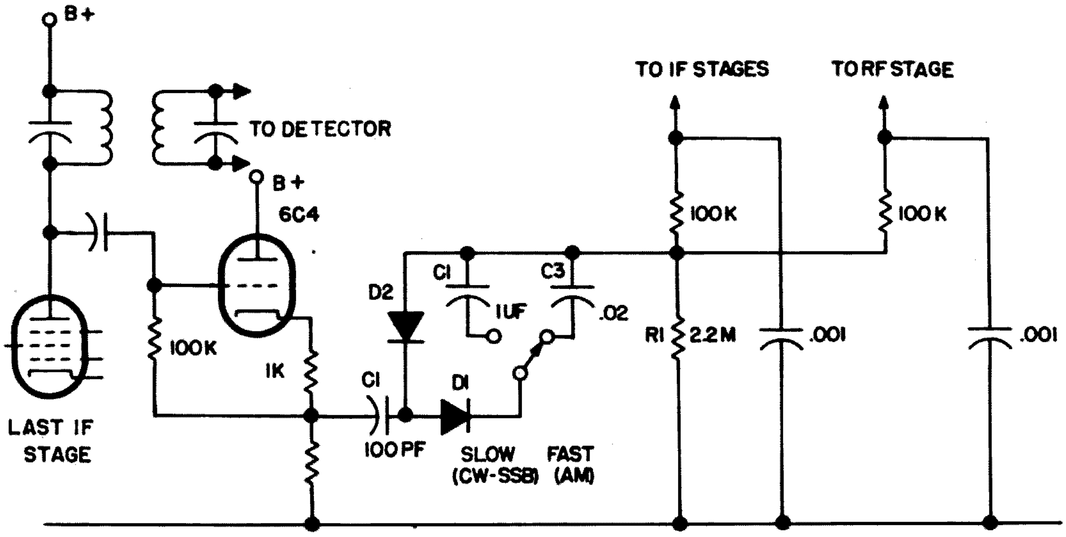

Fig. 4. Circuit for an improved agc system.

reduced. The simplest solution to the problem is to insert a cathode follower between the i-f amplifier and the agc rectifier as shown in Fig. 4. The cathode follower is characterized by a low output impedance and as illustrated in Fig. 5., the output impedance of the cathode follower is approximately 500Ω. Since there is little change in the voltage gain through the cathode follower stage, component values may once again be substituted in the equivalent circuit and re-evaluation of the performance made as shown in Fig. 5.

This evaluation shows that this agc system is characterized by attack and decay times very acceptable for CW and SSB transmissions. Various decay times can be

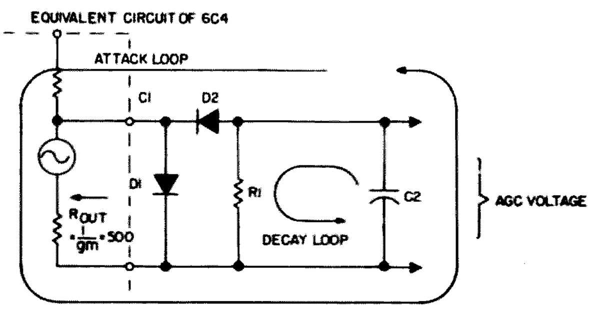

Fig. 5. Calculation of attack and decay characteristics for the improved agc system using an equivalent circuit. Attack time: Refer attack loop. T (seconds) = C (μF) x R (M) where C = C2 = 1 μF and R = R out = 500Ω = .005M ∴ T = 1 x .005 = .005 seconds = .5 millisecond. Decay time: Refer decay loop. T (seconds) = C (μF) x R (M) where C = C2 = 1 μF and R = R1 = 2.2M ∴ T = 1 x 2.2 = 2.2 seconds.

readily achieved by changing the value of C2. The actual value required for C2 to obtain a required decay time in this circuit is easily calculated using the following formula: C (μF)= 2.2/decay time in seconds.

Several values of C2 can be switched to achieve fast, medium, and slow decay characteristics.

In addition this improved agc system offers other circuit advantages:

(1) The cathode follower has a negligible loading effect on the last i-f transformer and hence does not cause any deterioration of selectivity.

(2) Because of the negligible loading effect on the i-f amplifier, greater gain is possible.

(3) The series diode gate in the rail actually doubles the agc voltage available from the cathode follower. This may be recognized as the half wave voltage doubler circuit wherein the voltage developed across C1 on the plus ve half wave cycle is added in series to that developed across C2 on the minus ve half wave cycle. Thus, although no true amplifier is used, the system exhibits increased control due to this voltage doubling action.

This improved agc system is capable of excellent results on both AM and SSB/CW signals and has proved to be a very successful modification to existing receivers that formerly suffered from poor agc characteristics when receiving CW and SSB transmissions.

. . .ZL2BDB

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A GALLON AND A HALF IN A GALLON BUCKET

Any number of articles have been written on the subject of using TV transformers in high voltage supplies. The usual method is to voltage double the entire HV winding and disregard all other windings in order to reduce the load on the transformer and thereby minimize heating of the core. This arrangement works well as evidenced by the number of these supplies in everyday use.

This article will deal with a method of dissipating the heat generated by the transformer, thus allowing greater current to be drawn from a given transformer without danger of catastrophic failure.

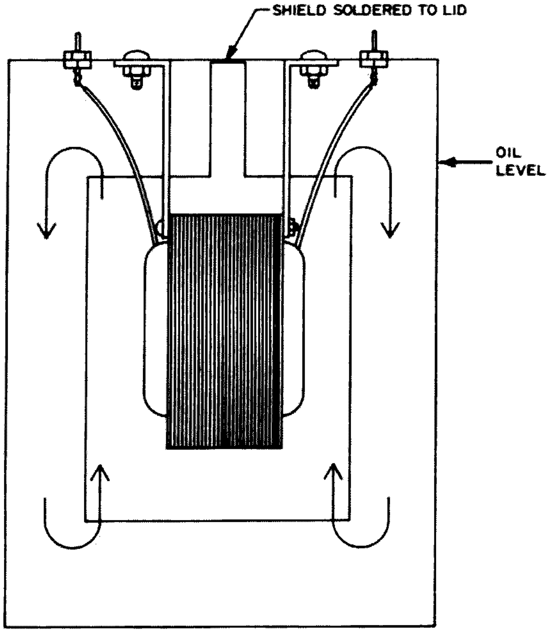

Fig. 1.

Taking a page from the Heath Cantenna, a gallon bucket was procured as the starting point. The transformer was stripped of its end bells and unused windings to improve heat transfer. Angle brackets were then attached to each side of the core at one end for mounting purposes. A fruit juice can was modified to form a shield clearing the core by ¼ in. or so. 1½ in. tabs were cut in the top of the can and the end ¼ in. bent to a 90° angle in order to space the main portion of the can about 1¼ in. from the mounting surface. Do not decrease this dimension, it provides room for the hot oil to expand.

The transformer is mounted in the center of the lid of the bucket by means of screws running through the lid and the previously mentioned brackets. The tabs of the shield are soldered to the underside of the lid after it is aligned with the transformer. The primary and secondary leads are brought out through feedthrough bushings.

Select a square of medium to heavy sheet metal the same size as the diameter of the bucket and after drilling a hole in each corner, silver solder or epoxy it to the bottom of the bucket. This will serve as a base for mounting purposes. Clean the entire assembly and paint the outside flat black. Fill with transformer oil to ¼ in.

Regency 2 Meter FM—American made at import prices

above the top of the shield with the transformer in place. This will require a slight bit of quesswork. Transformer oil is often available from the local power company in small quantities and at a very reasonable price.

As the transformer heats up, the oil directly in contact with the windings becomes warm and rises to the surface within the shield only to be replaced by cooler oil from the bottom of the bucket. The hot oil is cooled by contact with the outside of the bucket, which acts as a heatsink. By the time it reaches the bottom again the oil is much cooler and is ready to absorb more heat.

It is my conservative estimate that in SSB service a 50% increase in output current is available without running the transformer at elevated temperatures. There is some loss in output voltage due to the resistance of the secondary winding, but this loss is small in relation to the increased current available. I have run 1400W PEP using.this arrangement without difficulty.

. . .WAØABI

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THE HW22A-MORE VERSATILITY

Every owner of a Heath HE22 or HW22A can continue to enjoy full phone band coverage with this modification that permits operation in the new 7.150 to 7.200 MHz sub-band recently allocated by the FCC.

It can be safely assumed that the HW22A single bander from Heath and its equally popular sisters the 12A and 32A are in use by the thousands on 40, 75, and 20 respectively.

Let us consider for the present the HW22 and 22A 40 meter unit. This transceiver tunes 7.2 to 7.3 MHz and a very fine job it does. With the recent FCC decision to enlarge the phone bands, the owners of these little rigs are out in left field, so to speak.

Here is one simple answer. L6, the vfo coil, is padded with a 47 pF disc capacitor, designated C-205. If the ground end of C-205 is opened by a small switch, the rig now tunes 7.125 to 7.240 MHz which covers the new SSB frequencies. No retuning is necessary except to peak the final tune control.

The switch may be soldered directly to the ground lug for L6 and C205 and the lead from C205 will reach it, no holes to bore, no wires to change, and the rig can be returned to stock condition for trade or resale in about 30 seconds flat.

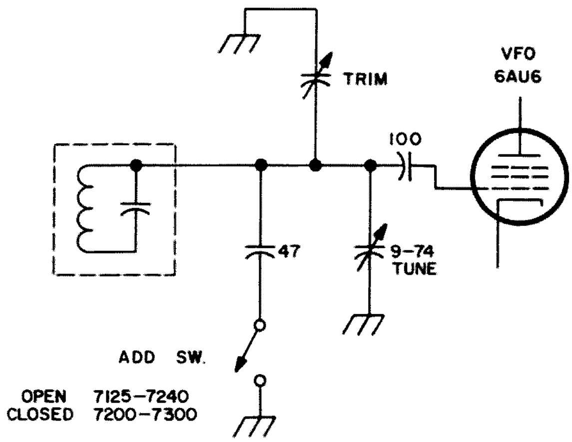

Fig. 1. Circuit showing the addition of a switch to shift the HW22A oscillator frequency.

As an added feature one can key V5 cathode and work a little CW for a change of pace.

This little change works out nicely on the HW22A as it is now in use, and no doubt the same thing can be done with the other two single-banders. By the way, the switch can be operated by a wire brought up through the top of the case. Stiff piano wire works fine.

...K7JVZ

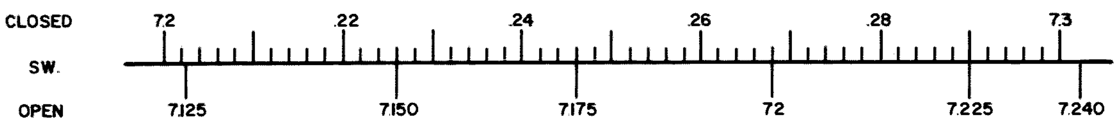

Fig. 2. New calibration scheme after modification.

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HAL ID-1 MODIFICATION

When our repeater group decided to add a CW identifier, we ordered a model ID-1 from HAL Devices. After it was received, our technical staff put it through a series of tests. We discovered that its operation wasn't quite what we'd had in mind. It identified on call-up, but was not designed to identify again unless another repeater call-up occurred after a "guard" period of 22 or more seconds following the first call-up. With the identifier timer set for the three minute interval, the next ID then occurred 2 minutes 50 seconds after the first ID. This sequence was not suitable for a "rag-chew" machine with a five minute timer, so we decided to modify the ID-1. This would disable the 22 second "guard" feature to allow identification at each call-up, and then identify again 2 minutes 50 seconds later if the repeater was still in use. We felt that no identification was necessary when the repeater was not transmitting. The modification would be engineered so as to make maximum use of existing components with a minimum of circuit changes.

ID-1 Circuit Operation

An examination of the circuit diagram of the ID-1 reveals that the unit actually consists of two sections: a timer section and an identifier section. In order to actuate the identifier section, a call-up input must have been received, and the timer must have cycled through. While the identification is occurring, the timing circuit is inhibited. After the identification is complete, the ID section sends a RUN signal to the timer section to allow it to operate again. The "guard" feature is the result of the timer section setting a flip-flop at the end of 22 seconds. Since this flip-flop is designed to clear when a call-up input is received, it must be set before the input can make it clear. Any input during this "guard" period will be ignored. The purpose of clearing the flip-flop is to provide a toggle signal to the next flip-flop to establish a partial enable for another CW identification. The identification will occur after the timer cycles

Modification

We decided to modify the ID-1 to allow the identifier section to be actuated independently of the timer, but to allow the timer to cycle while the repeater was in use. By cycling the timer, an identification could be made to occur 2 minutes 50 seconds after the initial identification, provided the timer was started from zero at each call-up. To start the timer from zero, it must be reset after each use. This is done by applying a signal to the "CLEAR" inputs of the flip-flops which make up the timer section.

Since the ID-1 is on a printed circuit board, the actual modification requires some care. Probably the best way to do it is to open the "runs" between components and install wires to the new points. The runs can be opened with a sharp instrument such as a knife point. It is not necessary to remove the entire run, just to open it at some point. The new connections are made with lengths of small hook-up wire. Additionally, two "OR" gates must be constructed and installed adjacent to the circuit board. Each gate is made up of two diodes and a resistor, and

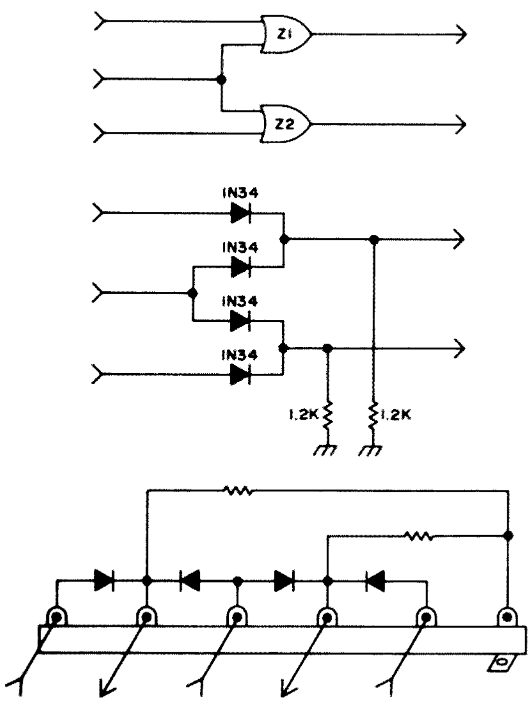

Fig. 1. HAL ID-1 Modification – OR gates.

both gates can be mounted on a single terminal strip (see Fig. 1).

The "runs" to be opened are: to IC #4, pins 2 & 3; to IC #8, pins 2 & 3 (pins 6 & 7 must still go to ground); to IC #11, pin 5; to IC #13, pins 9 and 12; to IC #14, pins 5 & 9; IC #14, pin 2 to pin 3; to IC #15, pins 2 & 3; to IC #16, pins 2 & 3.

Hook-up wire connections:

"OR" gate Z2 – output to IC #11, pin 5; single input to IC #13, pin 12; Z1 and Z2 common input to IC #13, pin 9.

Connect the "run" that previously went to IC #14 pin 9 to IC #14 pin 8.

Connect a jumper from IC #14 pin 8 to IC #14 pin 2.

Connect a jumper from IC #14 pin 5 to IC #16, pin 12.

"OR" gate Z1 – output to IC #4, pins 2 & 3; single input to IC #14, pin 9.

Also connect IC #14 pin 9 to: IC #8, pins 2 & 3 (pins 6 & 7 still to ground); IC #15, pins 2 & 3; and IC #16, pins 2 & 3.

Remove the .001 μF capacitor from the ACTIVATE input line, and replace it with a 47Ω resistor.

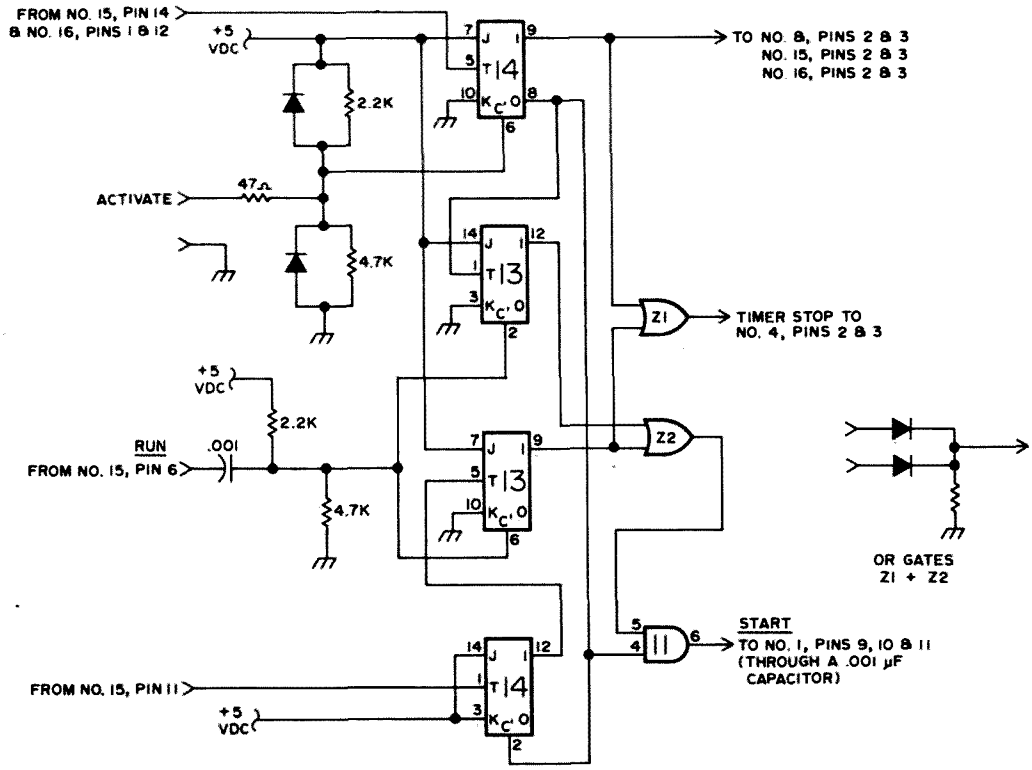

Fig. 2. HAL ID-1 modification.

Conditions: IC #13 pin 9 high; IC #13 pin 12 low; IC #14 pin 8 low; IC #14 pin 9 high; IC #14 pin 12 low.

The high from IC #14 pin 9 has reset the timer to zero. At repeater call-up, IC #14 pin 8 goes high, and pin 9 goes low. IC #11, pins 4 and 5 are now both high, causing a low to be felt at IC #11 pin 6, starting the identification. The high from IC #14 pin 8 is also felt at IC #14 pin 2, which releases the flip-flop for operation when a toggle signal is received. The timer is still inhibited through "OR" gate Z1 because of IC #13 pin 9 being high. At the end of the identification, the RUN signal goes low, clearing both flip-flops on IC #13. This releases the timer and inhibits the input to IC #11 pin 5. If the call-up was short (such as if someone keyed up the repeater to hear the identifier), the ACTIVATE line has gone high because the input is no longer present. Approximately three seconds after the RUN signal goes low, IC #14 pin 5 receives a toggle signal from IC #16 pin 12. This makes IC #14 pin 9 go high, stopping the timer. When IC #14 pin 9 goes high, pin 8 goes low, and IC #13 pin 1 receives a toggle signal. This causes IC #13 pin 12 to go high, preparing IC #11 to respond to the next ACTIVATE input, and resetting IC #4 to zero through "OR" gate Z1.

If the repeater call-up results in the use of the repeater, the ACTIVATE line will remain low, holding IC #14 pin 8 high and pin 9 low, allowing the timer to cycle. One minute 25 seconds after the ID at call-up, IC #14 pin 12 goes high as a result of the toggle signal from IC #15 pin 11. If the repeater is still in use 2 minutes 50 seconds after the initial ID, IC #14 pin 12 goes low again because of a second toggle from IC #15 pin 11. This provides a toggle signal to IC #13 pin 5, making IC #13 pin 9 high and causing a second identification to occur. The flip-flops in IC #13 are then reset by the RUN signal, preparing the ID-1 for another CW identification after 2 minutes 50 seconds.

This modification has been described in some detail in the hope that other repeater groups might benefit from the work of the WØJGL repeater technical staff. When you come to Denver, bring a set of crystals for 07/67 with you. Ours is an open machine, and we welcome visitors. We may not be number one yet, but we're trying harder!

. . .W3GHZ/Ø

Bernard Harris, Jr. K4PRT
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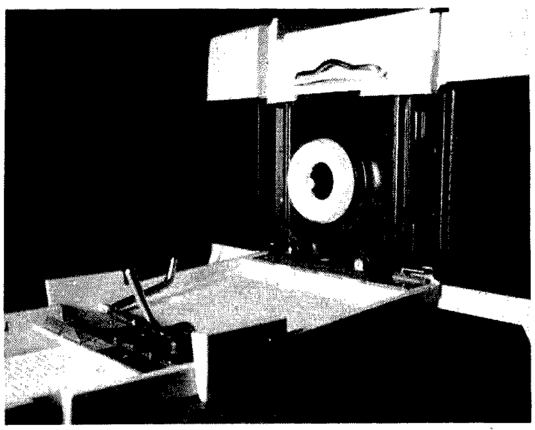
Fork Union VA 23055

POLAROID PRINT COPIER FOR SSTV

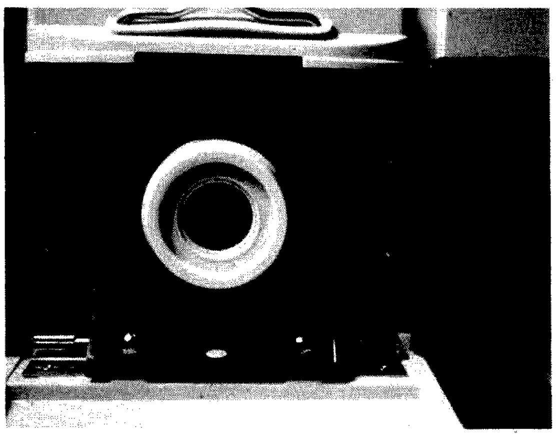
Having been on SSTV for a little over one year now and using the Robot SSTV equipment I have found that at times I desired a quick way to write calls, focus on pictures, etc., without having to use the magnetic letters that I have. I wanted something that I could insert a small card or picture in and then focus the Robot camera on for transmission of pictures. Such a device would have its own light source so that external lighting would not be required and it would also have its own lens so that close-up lens for the Robot camera would not be required.

Before going to the drawing board and work bench to build such a device, I decided to look around the shack to see if I had anything I could modify that would meet my requirements. For several years I have had a Polaroid Print Copier, Model 230, which was used with the old Model 80 Polaroid cameras to make copies of Polaroid prints. The copier has its own light source and its own lens. The only problem that I could see with using the copier as it was originally designed was that it had a large door (see photo) that must be removed in order that the Robot camera could be placed close to the copier to focus the Robot camera on the picture or writing that I wanted to be transmitted.

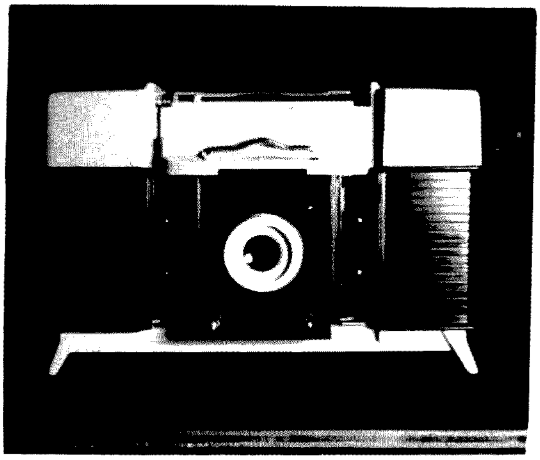
It is a simple matter to remove the door, which also has the lens attached to it. All that is required is the removal of the two nuts that hold the lens frame to the door and the removal of the pin that hinges the



Polaroid Print Copier before modification showing the door that must be removed before copier can be used for SSTV. Notice the 2 nuts just below the lens – these are to be removed along with the pin that holds copier door to the body.



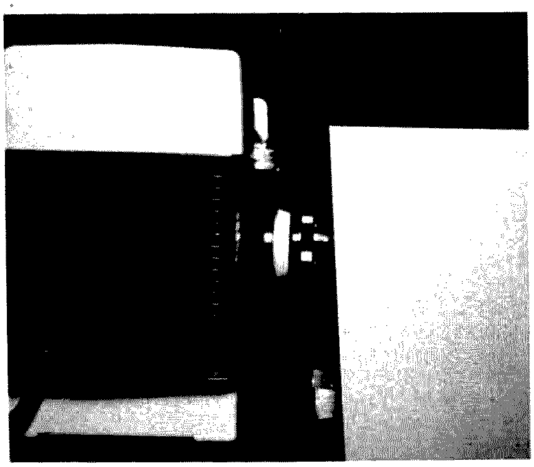
Close-up of Polaroid Print Copier showing lens, the 2 nuts that must be removed, and door hinge (pin must be removed).



Polaroid Print Copier after door was removed. Notice the two nuts on lens door – these are removed – merely shown here to indicate the ones that were removed. Lens door is glued back in place.

door to the body of the Polaroid Copier. With this done, you will now find it necessary to put the lens back, but this time without the door. Put a small amount of glue around the lens frame and place back on the Copier. The Polaroid Copier is now ready to be used with SSTV.

To use the Robot SSTV camera with the Model 230 Polaroid Copier first set the Robot lens to infinity and place the lens of the camera to the lens of the Copier as shown. Place a picture or small card in the Copier, turn on the light in the Copier, adjust lens opening of the Robot camera for the amount of light needed, and you are ready to transmit SSTV pictures. Some



Robot SSTV camera and Polaroid Print Copier being used to transmit SSTV pictures.

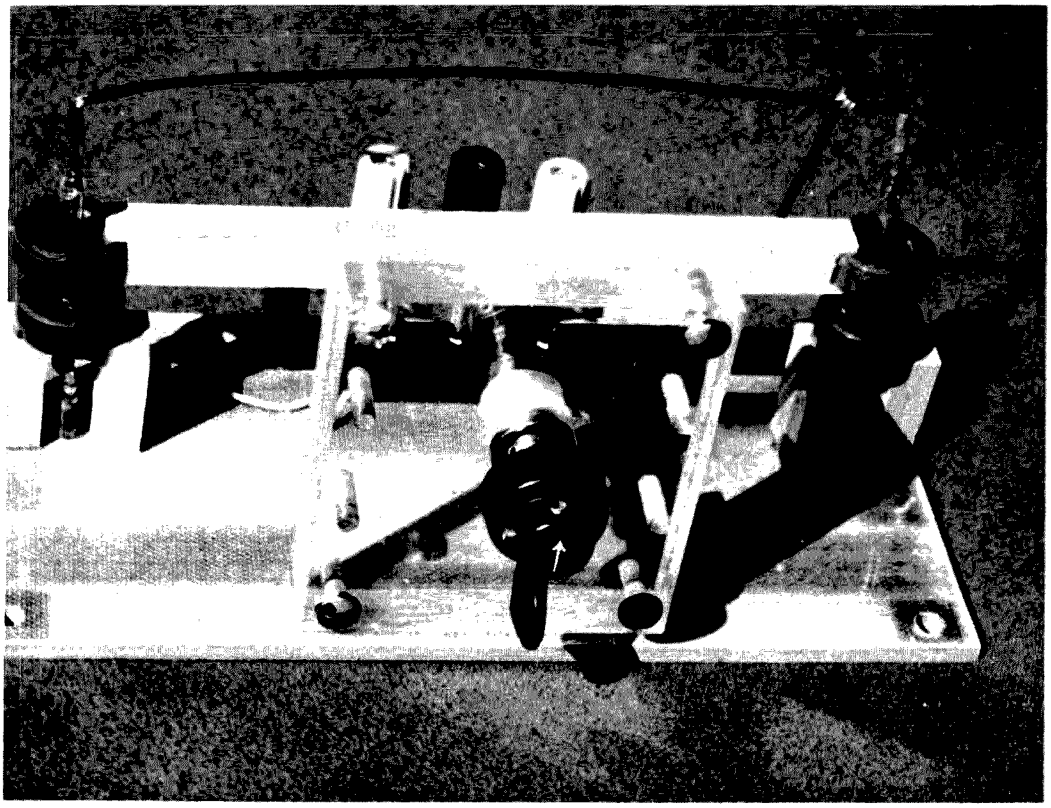
Picture made using the Polaroid Print Copier for SSTV.

experimenting will be required to see just how much writing can be used and the size of the picture that you can use, but this can be determined without much difficulty.

Picture that was used to make transmit picture using copier. Notice that in previous photograph only the head was actually transmitted.

As for acquiring one of the Polaroid Print Copiers – Model 230 – it should not be too difficult. The copiers cannot be used with the newer Polaroid cameras, and this particular model was designed to be used with the Model 80 Polaroid camera. It is my understanding that there are not many of the Model 80 cameras being used as it is rather hard to acquire films. The original cost of the Model 230 copier was about $29.95. It is suggested that if one of the copiers is desired that you contact some of the large photographic dealers.

. . .K4PRT



Chuck Hines K6QKL
8615 Idelwood Dr. SW
Tacoma WA 98498

THE FERROUS WHEEL CW PUMP

Unless tradition has grasped you by the throat or your concern for CW is limited by your gag reflex, you have a more than passing interest in the use of electronic keyers. They don't seem to inspire the sort of affection one feels toward a good receiver of faithful beam. Still, the keyer invokes the fascination of any good gadget. Push a button, turn a knob, and watch the thing go all by itself. The integrated circuit with its micro gates and flip-flops has made the keyer attractive to the amateur. The problem is mostly in what one uses to key the keyer.

Three states are selected by that device: dots, dashes, or nothing. Most keys are mechanical variations of the old straight key. A "paddle" is mounted so that motion or compression cause physical contact which in turn allows electrical conduction. A lot of silver and gold plating goes on those contacts in order to reduce their switching resistance. Even so, intermittent or unreliable keying is a frequent result. Keys of varying quality and reliability are commercially available. Flip through the ads. Note the swell prices on those joules. Eighteen to twenty-six bucks is about all you can get them to take for a key. Motivated by the usual theological conviction that money should remain in my wallet, I set out to build my own. The ferrous wheel CW pump was the result, and its construction is recounted here for your convenience and continued solvency.

The first problem is to get a reliable, low resistance switch. That has to be mighty low because the magnitude of the currents being switched is inordinately small when compared with the stuff we're used to switching around the shack. The magnetic reed switch has the admirable qualities required for the job. Hermetically sealed, able to cycle in a millisecond and handle up to an ampere, works in any position – and has a contact resistance in the order of 50 milliohms. Since the gadget is sealed, we won't have to worry about the contacts oxidizing and increasing in resistance, or dirt or stray fur from the cat getting inside. The switch configuration is sketched in Fig. 1. Just two pieces of overlapping metal mounted in a glass cylinder. The switch is normally open,

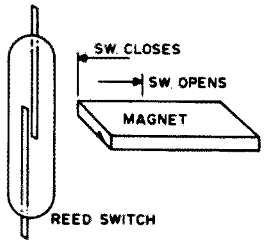


Fig. 1. Traditional reed switch configuration – two pieces of overlapping metal in a glass cylinder activated by bar magnet.

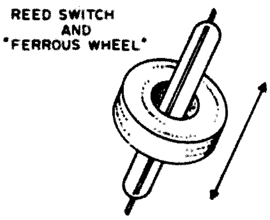


Fig. 2. Reed switch activated by "ferrous wheel" magnet.

and it is closed by moving a magnetic field into proximity to the middle of the cylinder. Reed switches come in different sizes and cost $1 or less. The reed switch has an imperfection, though. In Fig. 1 a bar magnet is brought up to the switch, and the switch closes at the distance indicated. As the magnet is withdrawn from that point the switch doesn't immediately open, however. The magnet has to be removed to the second position shown before the switch opens. This is inconvenient behavior. Clearly a key wouldn't function in an orderly fashion just by sloshing a bar magnet around in proximity to a pair of reed switches. Pity.

A solution was found in a doughnut shaped magnet. I'm calling this doughnut shaped magnet a ferrous wheel in order to make sure you or someone else doesn't confuse it with the ferrite toroids upon which sundry transformers are wound. The ferrous wheel is a genuine magnet. It has two poles. Two of them placed close together will either attract or repel one another – depending upon how they are oriented at the moment. The field of a ferrous wheel is quite different from that of a bar magnet, and you may enjoy sprinkling some iron filings on a sheet of paper and examining that field . . .

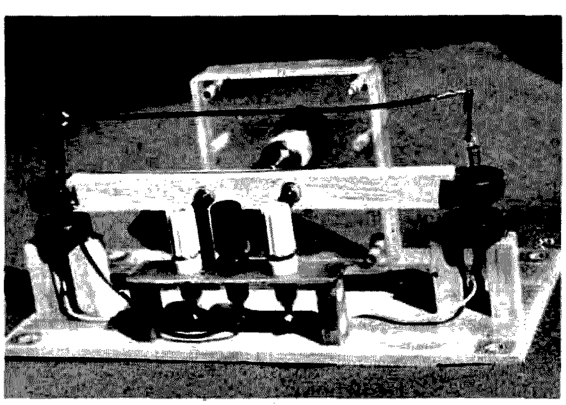
Now take a look at Fig. 2. A ferrous wheel is slowly moved with respect to a reed switch extended through the "hole of the doughnut." As the switch first enters the hole, the reeds close and then open again. This is not the switching region we want to use. Continue until the ferrous wheel approaches the center of the switch. You'll hear it click closed. With the switch centered in the wheel move one or the other and measure the total travel of the wheel necessary to allow the switch to open again. This distance is going to vary with the strength of the particular magnet involved, its shape, and the inside diameter of the hole. The minimum travel required on the wheels I used is three thirty-seconds of an inch. That's hardly the most sensitive switching device to be produced by contemporary primate technology. Still, it functions very nicely when configured as a pump.

There are a number of possible ways to configure a switch usable for keying purposes. For the preservation of symmetry I built the ferrous wheel CW pump pretty much as you see it lurking in Fig. 3. Now, if you bought your last key in 1927, and have had it anchored to the desk top with three wood screws ever since, this may take some getting used to. Don't rush it. Sit back and glare and let your stomach settle. The key begins with a pair of bearings mounted in a bearing block of some sort. A shaft extends through those bearings, and non-radial motion is prevented by a pair of keepers mounted on the shaft. At the near end of the shaft a knob is mounted. The far end of the shaft is fastened to the middle of a mast, and a ferrous wheel is mounted at both ends of that mast. Stand-offs are placed on the baseplate and one lead of a reed switch is soldered to each stand-off leaving the free end of the reed switch to extend vertically through a ferrous wheel. When force is applied to the knob, torque is placed on the mast, moving a ferrous wheel down over a reed switch causing the contacts to close. To allow the bar to return to its original position when force is removed from the knob, the repelling field of two oppositely polarized ferrous wheels is used. Since the forces balance on each side, they act much as two springs. Keying the pump unbalances

the forces between the opposing magnets. Releasing finger pressure allows the mast to return to its static, balanced condition.

Construction

The picture should answer most of your questions. For the most part the key is constructed of certified rubble and litter left on the basement floor from old projects. The base is a piece of fiberboard; the bearing block, two pieces of plastic bolted together and glued to the base. The mast and lower wheel supports are ½ in. balsa wood. The magnets used are from the toy counter of the local hardware store, come four to a pack, and are called "Magic Rings." There is nothing particular or special about them; use the lightest, strongest ones you can find. The reed switches used are GE-X7 packs available in the General Electric Experimenter line. (Very small reed switches are mounted in the reed relays available from Poly-Paks. There are four reeds inside the coil winding, each ¾ in. long, and they should be removed with great care if you plan to use them in this application.) The most reasonable source of bearings is surplus. You need two that will fit available shaft material. They usually fit tightly on the shaft, and the shaft must be carefully deburred after cutting. The shaft must turn freely in the bearings, and keepers are needed to keep the shaft from sliding out of the bearings. The pump is a cut-and-try affair and measurements are after the fact. The balsa mast is notched and the wheels glued in place with airplane glue. Wheel spacing is 7 in. center to center. Use what you like. If the mast is too short you'll lose mechanical advantage – and if it is too



What K6QKL's ferrous wheel looked like when it was done. All this beauty and it works, to . . .

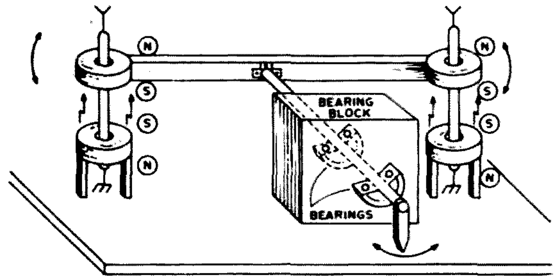


Fig. 3. Configuration of K6QKL's ferrous wheel CW pump.

long sensitivity is increased but there is a tendency to mechanical oscillation. Color code your wheels with a dab of paint so you can recognize their north and south poles. *Mount the wheels with the polarity orientation shown in Fig. 3. Like poles must be adjacent to one another.* Put the properly polarized bottom wheels over the stand-offs and solder the reeds in place. The gap between the top and the bottom wheels is, again, a matter of taste. Mine ended up about 10/32 in. apart.

Adjustment from this point on is a matter of piddling with spacing and balance and is most easily done by moving the reeds or bottom wheels up and down. When the mast is balanced both switches should be open. Pressure on the knob should close the switch with little movement. Equal pressures should close each switch. If the force required on the knob is too high, increase the gap on both sides between the wheels and their repellers. Be quite sure the repellers are mounted low enough so that *they* don't cause the reeds to close.

The ferrous wheel CW pump in the picture was built to see if an idea would work, and it did. Having established that, there is no reason yours should be so barbaric in appearance. With about five minutes' reflection you should come up with at least two other possible configurations of such a key, using essentially the same switching method but a different mechanical arrangement, construction technique, and materials. Try them. This is inexpensive ground to dabble in, and it is always rewarding to build something in a different fashion and discover that it works.

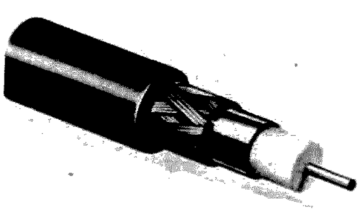
. . .K6QKL

... NEW PRODUCTS – *continued*

The output circuit features a bandswitch with 20A silver contacts switching a heavily silver plated coil. A vacuum variable is used for plate tuning. T/R switching is fast and quiet – full break-in is a panel selected function – through the use of vacuum relays.

If you are seriously in the market for a fine linear, write *Payne Radio, Box 525, Springfield TN 37172.*

LOW LOSS COAXIAL CABLE



Blonder-Tongue has developed a new line of coax cables for cable television networks. Twelve new types are available including RG-59, RG-6 and RG-11. Their top-of-the-line #4851 featues 12 gauge copper-clad aluminum center conductor and aluminum tape shielding with 50% aluminum braid. This particular cable has an attenuation factor of only 1.6 dB per 100 ft at 470 MHz! The RG-59 and RG-11 types, while not performing quite as well as the #4851, offer improved loss characteristics over regular foam types. They could be used to a high advantage where VHF or UHF installations require long lengths of cable. For more information write *Blonder-Tongue Laboratories, One Jake Brown Road, Old Bridge NJ 08857.*

CW FILTER

Autek Research has come out with a new audio filter that is going to be a big help to Novices and serious CW men alike. Their "Q-Box" is self-contained and affords variable audio selectivity from approximately 2 kHz down to 30 Hz by a simple twist of the selectivity control. There is no insertion loss and the output is high enough to drive headphones or an external speaker amplifier.

This unit is a must for anyone using an inexpensive receiver or a sideband transceiver in our crowded CW bands. All you have to do to put it into operation is to plug it into the headphone jack of your receiver, plug your headphones into its output plug, and turn the selectivity control to the desired amount of sharpness. This is made possible by Autek's use of a transistorized active filter that passes tones near the design frequency of 800 Hz and rejects all others (namely all that QRM right next to that weak signal you are trying to copy). The circuit is powered by an internal 9V battery and requires no power from your receiver.

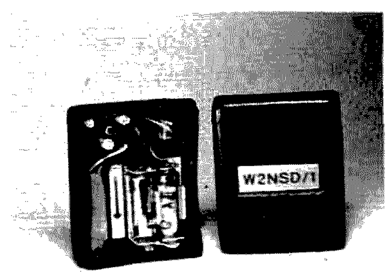
When the Q-Box arrived at 73, I immediately rushed it downstairs to the ham shack and connected it to our Signal/One. Tuning to the 40 meter Novice band/traffic-jam and adjusting the selectivity control back and forth only affirmed my suspicions . . . the Signal/One has an awfully good receiver section all by itself! The Q-Box did, however, act as a fine trimming selectivity control . . . it would be very useful in contests and when conditions really get rough.

After scrounging around a bit in the back workshop, I came up with an old home-brew receiver that someone had packed away years ago. Here was an excellent receiver with which to test the Q-Box. It had two i-f stages at 1700 kHz and the selectivity was bound to be awful. It was. The situation in the 40 meter Novice band was so jumbled that only exceptionally strong signals were readable. This was going to be an acid test! I plugged in the Q-Box and turned the control to maximum . . . what results! Each signal now occupied a tiny space in the spectrum. I had to back off on the selectivity control a bit, for the receiver just wasn't stable enough to use all that selectivity. Signals kept drifting out of the 30 Hz "slot" and would disappear. After adjusting things for a good balance between selectivity and ease in tuning, I went looking for weak signals. I found one that was perfectly readable and, seemingly, all alone. Was I ever wrong. Backing off on the Q-Box control caused that nicely readable signal to be clobbered by strong QRM that was lurking just out of the sharp bandpass. Being suspicious, and just to prove to myself that the QRM didn't just appear at the moment I turned the control, I turned the selectivity slowly up again. Just as slowly, the signal started climbing its way out from under the QRM and became copyable again.

The variable selectivity feature of the Q-Box is really a plus if you have had any experience with surplus toroid filters. The toroid filters could be switched either fully in or fully out. This caused problems if the desired signal was not tuned exactly on the nose, for you usually had to go looking for the signal all over again once the filter was switched in. With the Q-Box, the selectivity can be applied gradually as the receiver tuning is touched up to keep the desired signal centered in the ever-narrowing bandpass. The selectivity can also be tailored to the prevalent band conditions. If maximum selectivity is not needed, the control can be adjusted to a medium that allows good copy and effortless tuning.

While not quite as good as a steep skirted mechanical or crystal CW filter installed at the i-f level of a receiver, this audio filter can make the big difference between copy and no copy during bad QRM . . . especially if you *don't* have that expensive mechanical filter. $17.95 from *Autek Research, Box 1494, Canoga Park CA 91304.*

WIRELESS RECEIVER



No, this is not a grand announcement of the invention of radio. In fact, the new receiver offered by Lowcom Systems doesn't make use of radio waves at all. Operating on the principal of simple audio induction, it enables anyone to set up a reliable short range communication system for the home, shack, or even small business.

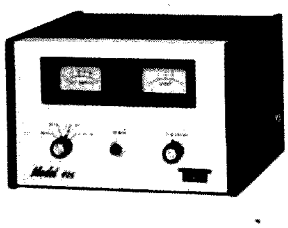
It works like this: A large audio field is generated. This is easily accomplished by stringing a wire around the area of proposed usage. The wire is fed by the audio from a ham receiver or PA amplifier and the volume is adjusted until a comfortable signal level is heard on the Lowcom unit. As long as you stay within the audio field you are in range. The larger the field, the larger the range.

One use that can immediately be thought of is repeater monitoring. Since repeaters are usually monitored continuously, every stray squelch-tail and "QRZ" echoing through the house just brings the situation closer and closer to divorce court. Why not

make everyone happy? Just string a wire around the outside of your attic and feed it with the audio from your FM rig . . . plug the Lowcom earphone in your ear . . . and walk around smiling. Do the same while you are waiting for the HF net to get started. No need to turn the audio gain way up while you are eating dinner. Just listen in on the Lowcom. No one will know the difference until half way between mashed potatoes and pie when you leap from your chair heading for the shack.

The unit is available for $15.95 in kit form or $24.95 wired from *Lowcom Systems, 10727 Indian Head Industrial Blvd., St. Louis MO 63132.*

TEN-TEC LINEAR



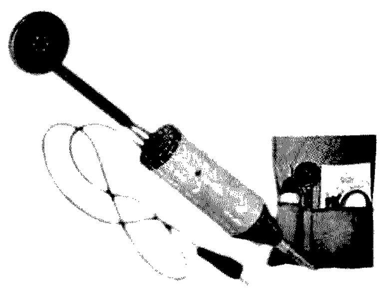
TEN-TEC Inc. has announced the introduction of the Model 405 Linear Amplifier to their line of amateur radio equipment. Completely solid state, the amplifier delivers 50W of power to the load in the frequency range of 3.5 MHz to 30 MHz when driven with less than 2W. Features include broad band design, two panel meters indicating rf power and standing wave ratio, exciter-actuated changeover relay with adjustable delay time and 12V dc operation. Its small size and light weight make the amplifier ideal for use in portable, mobile, marine and aircraft applications. The price is $149.00 – ac power supply is $49.00. Write to *TEN-TEC Inc., Highway 411 East, Sevierville TN 37862* for further information.

TEN-TEC RECEIVER

TEN-TEC, Inc. has announced the introduction of the Model 315 Communications Receiver to their line of amateur radio equipment. Completely solid state, the receiver covers the amateur bands between 3.5 MHz and 30 MHz. Features include permeability tuning, linear frequency readout, 9 MHz crystal lattice i-f, pulsed crystal calibrator and low noise MOSFET rf amplifier and mixer. Built-in regulated 115V ac power supply can easily be converted for 12V dc operation. An accessory plug-in audio filter is available to narrow the bandpass to 300 Hz for CW reception.

The Model 315 was designed for the amateur who demands the exacting requirements for DX, traffic, contest, net and general operations, as well as the beginner. Price is $229.00. Model 235 CW Filter is $14.95. For further information write to *TEN-TEC Inc., Highway 411 East, Sevierville TN 37862.*

PORTABLE TEST LAB



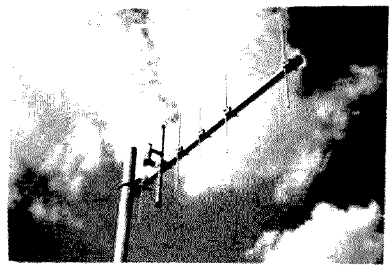
The Lee Labs Dynamic Serviset is quite a little piece of equipment. It is basically an rf/af signal tracer, but with a horde of extra features. Built into it is the ability to test the prsence of ac or dc voltage and substitute three different ranges of resistance and two ranges of capacitance. It can also test the resistance of a particular circuit and even determine the leakage of a capacitor. The amazing thing about this device is its ability to make fairly accurate checks on circuit conditions without the need for extra (expensive) equipment.

Because it is self contained, the Lee Serviset makes troubleshooting really easy. This is especially true when working on tiny printed circuit boards. The work area doesn't have to be cluttered with a tangled mess of test leads coming from VOMs, resistance substitution boxes and transistor checkers because you can perform all those functions with one hand held unit. Functions are selected by repositioning a single test load.

Suppose you have traced a signal in a malfunctioning receiver up to, say, the second i-f stage, but you lose it as you go on to the next. By changing the test lead position on the Serviset you are able to use it as a voltmeter to check the corresponding voltage levels at different points at the i-f tube or transistor. If no voltage appears at the plate, the Serviest can then be used to check the condition of the load resistor and bypass capacitor. If one of these are found faulty, the unit can quickly substitute a value to confirm the fact by restoring operation. Sounds easy? It is.

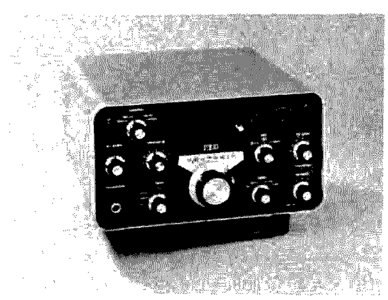
The Dynamic Serviset is manufactured by *Lee Electronic Labs, 88 Evans Street, Watertown MA 02172.*

450 MHz YAGI



Cush Craft has just introduced a new 6 element rear mount 450 MHz yagi for amateur FM repeater operation. It can be used for control links and stations for monitor applications and access to 450 MHz repeaters. It is priced at $10.95 amateur net and exhibits 10 dB gain. It has direct 50Ω Reddi Match feed with built-in coax fitting. The boom is 35" long and overall weight is 3 lbs. Model No. A449-6 is available through all Cush Craft distributors. The antenna is also available for commercial service. *Cush Craft Corp., 621 Hayward St., Manchester NH 03103.*

SOLID-STATE SWL RECEIVER



Heath Company, world's largest manufacturer of electronics, has brought to market a new professional solid-state SWL receiver, the Heathkit SB-313. The unit covers 9 switch-selected shortwave bands between 3.5 and 21.8 MHz; receives SSB, CW, and AM with professional performance. A 5 kHz AM crystal filter is supplied with the kit, with separate SSB and CW crystal filters available as optional accessories. Outstanding stability, selectivity and sensitivity are the result of advanced-design all solid-state circuitry including 19 transistors – four of which are MOSFETS; 11 oscillator crystals and one IC. Preassembled and aligned Heath LMO

offers good linearity and highly stable tuning. Large dial calibrated in 1 kHz increments makes for easy tuning. An IC crystal calibrator provides markers every 100 kHz or 25 kHz. Other features are a transistor-regulated power supply for stable voltage to all oscillators under varying line and load conditions; an rf attenuator that allows adjusting sensitivity for best signal handling; virtually backlash-free dial tuning; modular plug-in circuit boards plus ready-to-use wiring harness for easy assembly; and special extender boards for troubleshooting even while set is operating. An 11 MΩ input VTVM, and 8Ω speaker or headphones, and an antenna are all that are required for alignment.

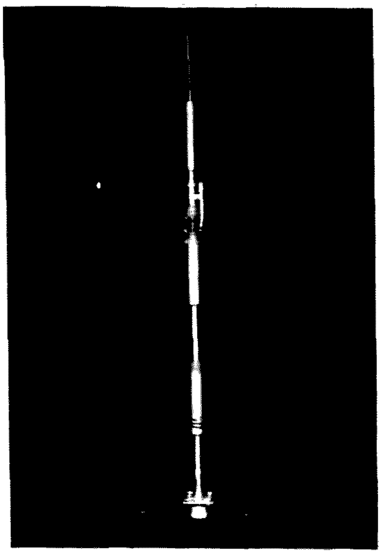
Kit is mail-order priced at $339.95 F.O.B. Benton Harbor. For further information, write *Heath Company, Benton Harbor, Michigan 49022.*

"M" SERIES MOBILE GAIN ANTENNA

The "M" Series antenna by Antenna Engineering is a full 5/8-wavelength vertical whip with a bottom-load matching transformer. It is designed for vehicle-mounting in a 3/8-inch hole. The adjustable threaded bushing allows for either roof-mounting or through double-panels. The matching transformer is encased in a fiberglass sheath which is nearly indestructable. The whip is of 1/8-inch spring-temper type 302 stainless steel; the coil tip unscrews to accept a chrome-plated spring (optional at extra cost) for severe service applications.

This antenna is available for all amateur frequencies in the 146, 220 and 440 MHz bands. The "M" Series antennas are at dc ground for dissipation of static, and are supplied with 20 feet of type 58A/U coax and UHF connector. Prices range from $16.95 for the 2 meter version to $15.95 for the 3/4 meter version. Contact *Antenna Engineering Cc., Inc., P.O. Box 19449, Indianapolis, Indiana 46219.*

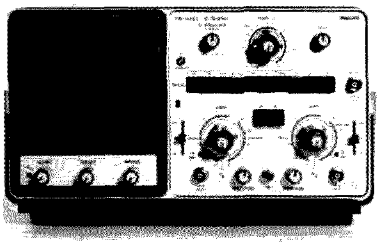
"B" SERIES BASE STATION COLLINEAR



The "B" Series antenna by Antenna Engineering is a triple-skirted collinear antenna operating with a decoupling ground plane. These are seven quarter wavelengths, designed for vertical polarization, and are available for all amateur frequencies in the 146, 220 and 440 MHz bands. Unlike many antennas of this type, the "B" Series is at dc ground for positive lightning protection, and the gamma-type feed is located on the radiating structure for symmetrical current distribution. This feed system will match 25 to 100 ohms for use with various transmission lines and in phased-arrays.

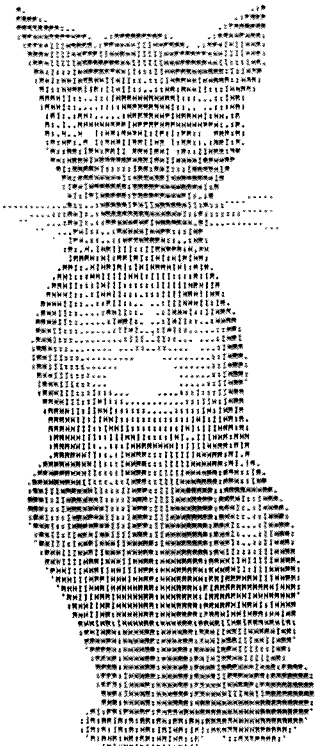
The supporting mast is heavy-wall 6061-T6 aluminum alloy, and the radials are spring-tempered type 302 stainless steel. A mounting receptacle is provided for 1-inch NPT pipe. The unit is quite rugged for its light weight. Termination is by type 8/U coaxial cable. Prices range from $39.95 for the 2 meter version to $29.95 for the 3/4 meter version. Contact *Antenna Engineering Co., Inc., P.O. Box 19449, Indianapolis, Indiana 46219.*

DUAL-BEAM SCOPE



This new Philips instrument is offered at approximately $900 as the successor to the widely used Philips PM3230 for a wide variety of applications in industrial electronics including telecommunications, television, education, computers and peripherals, and electronic maintenance.

The PM3232 combines a number of features that can often eliminate the need for a more expensive, higher bandwidth instrument when only one or two individual features, such as 2 mV sensitivity across a wide band or dc triggering, are required for a particular application. In addition to being a true dual beam instrument and therefore having no possibility of phase displacement between the two traces, the PM3232 also offers universal triggering facilities including automatic level, dc coupling, and automatic TV line/frame selection. Its sensitivity is 2 mV/cm everywhere in the 10 MHz bandwidth of the instrument. The newly designed Philips CRT has a large 8 x 10 cm screen and excellent light output dervied from the post-deflection acceleration system so that even low duty-cycle, fast-sweep signals are displayed clearly. Detailed information on the PM3232 and on the entire line of Philips instruments available in the U.S. may be obtained by writing to *Test & Measuring Instruments Inc., 224 Duffy Avenue, Hicksville, N.Y. 11802.*



RTTY ART

Here is an example that originated with Don WA6PIR. Have any good examples that you want to see in these pages?

LETTERS

THE COVER...

My husband is a ham and enjoys 73 very much. On occasion I will pick up one and read a few articles and enjoy them also.

I ran across the Letters section of the December 1972 issue that I would like to comment on.

After reading Mrs. Shera's letter about the October cover I decided to conduct a little experiment. I asked my husband his thoughts on the October and November 1972 covers. He thought the "equipment" was really outstanding. My husband is an admirable man and only has the best of intentions.

Therefore, I'm sure there were no adulterous thoughts lurking in his mind. If a man gets to where he doesn't enjoy looking at a pretty girl, my best suggestion would be to find the closest mortician!

I would like for you to please give equal space to Mr. Shera and let us hear his opinion of the covers in question.

Keep up the good work at 73 and please use a picture of Burt Reynolds on one of your covers to please the lady readers of your magazine. Who knows, Mrs. Shera might like that.

Mrs. H. Hogan, Jr.
Cheraw SC

But then . . . would your husband write us a nasty letter??

Sent in my renewal last week, and after getting the November issue today, I am glad I did.

About your new cover format, that's a cute rig she's holding, but my non-ham O.M. is beginning to wonder about the magazines I subscribe to! I suppose with the small number of licensed YL's, we'll have to resign ourselves to being addressed as "Mr." or "O.M." – but couldn't you at least refer the cheese cake minded to a different magazine? Or at least give us YL's a good looking man to look at!

Mary Haynes WB8MAV

Normally I'm not a complainer, but lately the YL has become very suspicious with all the brown-wrappered 73's which have appeared at the door. Naturally, when I tell her that it is only 73 Magazine, a radio magazine, she looks at the cover and doesn't believe me, because of accessories often attached to the equipment, which aren't often included in the purchase price of the otherwise – I'm sure – good equipment. It has occurred to me that maybe you ought to put a centerfold in 73. However, to please the YL, it should be some complicated circuit, instead of a complicated blond, like "that other magazine." It's not that I have anything against blonds (after all, they have more fun), but somehow, I think a radio magazine ought to have a fold-out circuit. If you need to fill the other side of the centerfold, maybe a blond would be good (it would save me money, since I wouldn't have to buy the "other magazine").

Seriously, I enjoy 73 and hope you keep up the good work. It will probably take me a month, though, to read your last issue, since I can't seem to get past the cover.

Kent Cronyn WA2DRX
Tiffin OH

I am a high school student and generally take 73 to school to read in my spare time. But if you insist on putting on cover pictures such as on the October and November issues you will end up thinning your youth ranks considerably. All kinds of rumors have been started about me and I was nearly expelled once before I could prove that it really is an amateur radio magazine. Believe me, people don't notice that the lady on the cover is holding a 2 meter rig. Please consider my plea before I end up in big trouble.

Steve Antosh WB5BNM
Shawnee OK

A comment on the November issue . . . WOW! I haven't had a chance to get an actual count, but there must be more articles in this one issue than in an entire year of QST and CQ combined. Who wants 40 pages of operating news anyway?

When I first saw the issue on my desk, I was sure you had finally published your cumulative index, or at least the entire FCC rules and Regs. Let's see CQ top this one.

Ron Warren WA2LPB
Fredonia NY

Thanks for the fine November issue. In fact, your covers the past few months have gotten my wife interested in what I'm reading – and she might become a devotee if she sees enough of those type of covers; she doesn't want to let me read anything like that without her knowing what's in the center(fold?)!!

Wayne Heck WB9HJM
Ft. Wayne IN

My lawyer will be in touch with you. As you can see from the address, I am in the Folly Beach General Hospital with a hernia received trying to get the November issue of 73 out of its wrapper.

(Seriously, am glad you stayed home awhile to mind the store. November issue is great. Always thought you could do it if you would stop running all over creation & attend to business. Am proud of you.)

Ed Howell W4SOD
Folly Beach General Hospital

First my dog attacked my mailman, then you people at 73 sent this magazine (November '72), its size massive, gigantic and dynamic. This was the last straw for my trusting and loyal postal servant. Things here in Vancouver are about ready for the A.R.E.C. My dog and I thank you so much; keep it up!

Jerry Dimmitt WA7MMD
Vancouver WA

I am sure the Womens Liberation Movement would dub you a "male chauvinist pig" as a result of your November cover.

What disappoints me is that you have an excellent magazine and you really do not need bullshit like that to sell it; or is it possible that you really do not know how good your publication is?

Mike Peters W9GHY
Scandinavia WI

As spokesperson for the 73 Women's Lib local chapter, I assure you Wayne was labeled a Male Chauvinist Pig long, long before the November cover.

However – in all fairness and because he is our boss – I make the point that the young lady willingly posed for the bullshit, so what does that make her?

And you know – most of you DO like the cover!

Ruthmary Davis

P.S. We don't know it is an excellent magazine because we aren't hams, but Wayne tells us it is.

WA6TDD

I suppose that the following is my own fault for not writing earlier and correcting it. In your recent Repeater Listings and other ones around, they show WA6TDD in L.A. as hasing an input of 147.420 MHz, with an output at 146.40 MHz. The inputs, of which there are two, is FM at 147.435 MHz and AM at 147.405 MHz. I realize this is an odd-ball situation. TDD has been an AM open channel repeater on Mt. Wilson since Nov. '62. At the time we were at 145.425 MHz, with the AM input. The repeater was always very active except for approximately one year's time when it was off the air for many reasons, none to do with amateur radio. Last April we added an FM input at 145.195 MHz.

These frequencies were picked due to intermodulation problems on Mt. Wilson and at the same time to fit in between the other activites on two meters in the L.A. area. The activity was about equal between the two inputs, with both growing equally. When the docket came out it forced us to make a ddecision whether or not to abandon the AM or the FM input. The "Frequency Coordinating" Committee was not about to let TDD have two inputs. I can understand their thinking in part. But contrary to public belief there is a great deal of interest still in AM mobile operation. The people that operate the other repeaters that are FM only are not aware of the AM operation on the band. Besides the attitude that is shown by many that "Ancient Modulation" does not need a repeater, so TDD should only have one input and one output. This was put to the users of WA6TDD as to what they wanted to do. We decided that we would split the input channel and have both the AM and FM inputs. Both receivers have always had the overall band-pass to operate in this manner. We used to have a CD group operating about 15 kHz off of the AM input without any interference. But it meant that the users of TDD had to either have good VFOs or accurate crystals. They got 'em and used 'em.

Burt I Weiner K6OQK
Van Nuys CA

MINICOMPUTERS

I just received and perused the Nov. issue of 73 and was utterly boggled by its size and content; I wish your advertisers and staff time would allow things to "get out of hand" like that a little more often!

As a professional computer programmer/sometime computer-maintenance technician, and a reader of 73 almost since its inception, I was particularly delighted to read Jim Huffman's introduction to the design of minicomputers. I agree with his premise that increasing IC sophistication and declining costs will very soon place home-brewed minis within the reach of most hams and experimenters, and it seems entirely appropriate (and perfectly in keeping with 73's tradition of publishing "meaty" construction projects using state-of-the-art circuitry months ahead of any other experimenters' magazine) that such an article should appear in 73. In fact, I would have been gravely disappointed had "Popular Electronics gotten there ahead of you!

In addition to concerning themselves with the design and construction of a mini computer, it seems to me that hams would do well to give some thought to the incorporation of minis into amateur communications systems; for example, for microwave enthusiasts to begin discussing and exploring the possibility of establishing amateur data-communications systems, not only between ground-based stations, but also with an eye toward the possibility of utilizing digital-data transmission in future OSCAR-type projects.

The Intel Corporation (3065 Bowers Ave., Santa Clara CA 95051) manufactures a unusual MOS LSI chip, the 8008, which includes the entire "guts" (i.e., Arithmetic-Logical Unit, Instruction Decoder and Control, several internal registers, an I/O-bus buffer, and timing generator) of an 8-bit minicomputer in an 18-pin DIP; essentially it's a CPU-on-a-chip which need only be interfaced to a memory sub-system and some appropriate I/O device-controllers to make a fairly sophisticated bus-oriented mini. The manufacturer publishes a data-booklet describing the 8008 and several other chips that make up its "MMCS-8 Micro Computer Set" which presents an excellent description of the operation of the CPU, how to incorporate it into a minicomputer, how to build a simple Teletype controller, and lots more. It's an excellent supplement to the Huffman article, and worth its weight in gold to would-be computer constructors.

The chip itself, I'm told, costs about $200 for single quantities, which is outta sight for an IC, but dirt-cheap for a computer.

In summary, I see great room for experimentation by hams in the development and use of minicomputer systems, and I am pleased to see an initial presentation of the subject in

73. I would like very much to encourage readers with an interest in this field to get to work on concrete hardware development, and hopefully share their results with us via 73.

Scott Marovich
Chicago IL

My article in the September issue, "The CW Excavator" has an error that may cause some unsuspecting experimenter to test his religion or maybe blow his top: on page 32 the equation for bandwidth and R_1 are in error. The equations should be

$$R_1 = \frac{1}{\omega_1 Q_1 (C_1 + C_2)} =$$

$$\frac{B_1}{2\pi f_1^2 (C_1 + C_2)} \quad \text{where } \omega_1 = 2\pi f_1, \quad Q_1 = \frac{f_1}{B_1}$$

Consequently the equation forbandwith should be

$$B_1 = \omega_1 f_1 R_1) C_1 + C_2) =$$

$$2\pi f_1^2 (C_1 + C_2)$$

The next to the last paragraph has a few words missing from the second sentence. The second sentence should read: The gain of the filter is about unity for 800 Hz, so there is little change when the filter is switched "in" or "out," but a comfortable level phone signal with the filter "out" disappears when the filter is switched "in."

For what it's worth, the article seems to have rung a bell for many of your readers, because I had letters from several asking about PC boards and IC substitutions a full two weeks before my subscription issue arrived.

Parker R. Cope
Amsterdam NY

Didn't you come on a little bit too strong in your editorial "Incentives" in the Sept. issue of 73? I was forced to read your editorial twice, as I couldn't believe quite what had been written.

I have often felt that the FCC examinations for the incentive licensing program were for the most part pretty fair. Some areas of a particular exam might possibly be rougher than others – dependent upon each individual's own preparation and interests. However, no portion of incentive licensing should be condemned as you did so with the code.

As the top grade within the amateur radio licensing structure, the Extra Class license should require knowledge and proficiency in the basic aspects of amateur radio operation – mainly, voice and code.

Your editorial, as I read it again, didn't even mention that Extra Class license holders are granted additional allocations of our bands for CW operation, not just the additional bandwidth for voice operation. Perhaps this is why the FCC has the 20 wpm code requirement in addition to the technical examination.

If anyone has the right to complain, it should be the dedicated CW operators who are required to pass the Advanced Class license examination in order to be eligible to sit for their Extra Class ticket. What does the CW operator do with additional phone privileges? This surely must seem unfair to many.

As amateur radio operators, we should, as we are now required by FCC, be virtually proficient in all aspects of amateur radio – not just in the area of our own personal interests. Nonetheless, the exams are there and we must live and abide by the rules, regulations, and requirements as imposed by FCC until such time they are changed or amended – no matter what our personal feelings or interests tend to be.

Marc B. Miller XW8EV/K3NAS

73 Magazine is the best ham magazine I have read – the ads are best because you have confidence in them.

The "Petition to the FCC" by George W. Fyler W9JT, was the best I ever read. It is clear (to me) that he should be writing the FCC Rules and Regulations for the FCC. Can we not petition the "President of the United States"? The FCC has too much power for such little action and consideration. I am a member of the ARRL but I feel they go along with the FCC. Anyway, I worked for the Federal Government for 32 years. "Nuf" said.

I will help any way I can in the above Petition, but?

Bill WB4SNK
Jacksonville FL

K4YKB and his "TEN-ROGER" dissertation (Nov. 73) sent me into hysteria! Paul Rinaldo of McLean VA has run-off one of the most ungodly truth filled articles I've had the pleasure of digesting in a great long time.

It is my misfortune to be among the fraternity of the few remaining "legal" CBers (KFA6162) that date back to about 1959 when the band was being used for the purpose intended; and now it's a #*+%&@$%S mess to say the least.

It was reported that one of the local L.A. CBers purchased for cash money across the counter (name of store undisclosed) one of HENRY RADIO's hard punching KW "afterburners" – that will give you some idea of what we might expect on the proposed "CB 220 MHz" deal.

So, come on hams – get your 220 gear on and shoot the Federal Candy Company some of that there "wall-paper" protesting the EIA proposals – TEN-ROGER yaall?

Bill Ford WB6SNU/KFA6162
Pomona CA

I saw your editorial regarding the elimination of CW as a requirement for the Extra Class license and thought I'd give you a CW operator's point of view.

Since you do not operate CW, the only band segments you have lost are a small section of 75 and 15 meters. But as a General Class licensee and a CW operator, I have lost the choicest 25 kHz segments from four bands. The 20 wpm code exam is nothing for me, but why should I have to learn a lot about single sideband just to crank my vfo down to the bottom 25 kHz of each band? I feel that the *only* requirement to operate in the Extra Class CW bands should be the code exam.

When it comes time to renew my license, at least I can state with a clear conscience that I still have the minimum code speed required for my class of license. I wonder how many of the "phone only" operators can do the same.

Bruce Koehler WBØBCT

(Most, I think, for I notice my code speed does not change much even when I don't use it for a year or so. It only takes a couple minutes to get back in the swing of it. Wayne.)

I am a CB'er and am trying to get involved into this 220 bit.

I would like to say right here and now, I feel the amateurs are entiled to 220, and the fathead who thought of using 220 for "CB" should be stood up against a wall and shot!

Yes, CB is crowded and noisy, but if the money hungry idiots at this EIA, a reactionary outfit, would just get it through their fat heads, they'd realize there are plenty other frequency ranges available, not necessarily amateur radio bands, but possibly the government would give up one of their sacred bands.

Then there is the possibility thatCB could go FM (no offense intended), and possibly some other modes such as, preferably, RTTY.

You all think I may have a wild imagination, but I'm not very interested in amateur radio (sorry about that!), but experimentation of CB with such modes would be most interesting for those like me.

Enclosed is a money order for one of your "220 use it or lose it" shirts.

Jim Buscher III
Arlington VA

Immediately upon reading Cliff Klinert's excellent article on solid-state ID in the October issue, I set forth to produce a unit for our new repeater here in Norwalk, Conn.,

W2NSD/1 continued......

MAY WE GET 11 METERS BACK?

It's pretty definite now: the Crazy Bunch will be coming to 220 MHz – that's the bunch now filling up the eleven meter band with illegal power – illegal antennas – illegal towers – illegal VFOs – illegal skip contacts – illegal hamming – illegal call signs – unlicensed operation – profanity and obscene language – widespread use for crime communications, which is illegal – and so on.

While the amateur frequencies that are going to be turned over to this bunch of . . . unusual people . . . are probably the most valuable and needed ham channels presently not in use, there are some shreds of silver lining to the situation. If FM continues to grow as it has during the last two years it won't be long before the pinch for repeater channels will be painful and the realization will come that amateur radio goofed and goofed badly when it did not set up a lobby in Washington to protect its turf.

Now, for the bright side. When the CBers are scraped off the 27 MHz band and shoved down onto 220 MHz, it seems possible that this band may again be opened for amateur use. Since the neighboring ten meter band is far from bustling, even during peak periods, 11 meters could languish as it did in the '50s unless something extra is allowed. Perhaps this might be the band where the FCC would permit long distance repeaters.

DXing repeaters would be fun, and if we could tie them into our VHF and UHF repeaters with crossband links, they could be extremely valuable for emergency purposes. There is no real shortage of frequencies on the ten meter band for this, but the FCC has conjured up some sort of imaginary congestion that might take place twenty years from now and come down hard against ten meter repeaters. Perhaps the wide open spaces of 11 meters would counter this thinking.

HOW WAS 220 MHz LOST?

The FCC bowed to pressure from congress via the well-heeled EIA Washington lobby. Anyone interested in the inside story on how this situation works has but to read the current best seller, "Who Runs Congress." This is the $1.95 Bantam Books ZY7701 Ralph Nader congress project report.

Since it is estimated that over 90% of the prospective sales of 220 MHz equipment will be of Japanese manufacturer, one wonders just who is actually bankrolling the EIA push for the band. Ah, so? The fact is that the new band will make millions of dollars for Japan – perhaps up to $100 million per year. They'd have to be daffy not to invest a few million in a proposition like that – and no one has accused the Japanese of being daffy yet.

The Nader report will give you the lowdown on how money passes from interested parties through lobbyists to congress, thus buying little baubles like a meg at 220 MHz for the Crazies.

LESSON LEARNED

Readers of the aforementioned Nader congress report wil find that the suggestions made in 73 for hams to have a Washington lobby are backed up completely. Without such a lobby the amateur frequencies are wide open for any group to grab. Only the complete lack of any lobby in Washington for amateur radio made this theft of ham frequencies possible. You might ask your ARRL director to explain again why ARRL has no lobby to represent us in Washington. This has been explained in the 73 pages many times, but is an unpleasant situation and we tend to forget about it.

We need a group to set up a lobby – we need it desperately – where are you – were are you?

CAN HAMS GET SOME TOO?

Any enterprising ham should be able to do very well as soon as the new band is announced. Nice Japanese rigs will be available from Henry, Standard, and others such as Drake, SBE, Swan, etc. Even crystals will be available from Japan for a fraction of the cost of U.S. crystals. Antennas will come pouring in from Japan too. If you want to get into a good big business you can get yourself set up as a dealer and start installing these CB stations and servicing them. Any FMer has the knowledge to set these things up and keep them going.

If this band goes the way of 11 meters – and there is no reason whatever to expect anything different, you may be into selling towers, high powered amplifiers – the works. Watch for some interesting new amplifiers for the band too – several manufacturers are ready to announce some 250 and 500 watt mobile solid state amplifiers – and one is hard at work on a 1000 watt mobile amplifier for the band!

CBers found that once they are on a band in large numbers there is nothing the FCC can do to police the situation – so anything goes. No licenses are needed, obviously. A chap with a base station might worry a bit if the FCC starts a cleanup in his area – but these things never last long and it is always back to business as usual in a few weeks at the worst – and of course there is virtually no way for the FCC to catch a mobile station, so mobile ops don't even have to worry when the FCC is right in town.

Another good business may turn out to be setting up remote base stations for the new CB band. CBers like to work DX and get good wide coverage – and this means a mountain or tall building. Few CBers will be able to hook up the remote control circuits needed for a good remote base station – so there is a fine opportunity for experienced amateurs.

Most of the CB rigs will probably be either crystal controlled or synthesized – which means that there will be a possible market for VFO's for working in between the 25 kHz channels.

Wayne

LETTERS continued......

W1WHZ. I got about fifteen minutes down the line, when I realized that all of us here in "1"-Land, and I'm sure, many others, have a problem with overloading the eight-bit capacity of the 7430 IC's. Cliff does spell out a rememdy for this in his article using an inversion process and some additional 7400's. While this will certainly work, it does involve some more complication and cost and it reduces the ability to construct a "universal" ID unit which can be easily changed to a new call sign if necessary. This will be important in view of the new repeater rules which will require all of us to change calls in the near future.

I think I have a simple solution to the problem which may be of aid to those of your readers who find themselves in this same situation. The answer, as simple as it may sound, is to allow six units for letter spacing rather than five. This will allow enough room for almost all combinations of characters, with the exception of the poor guy who has a zero in his prefix. There does not seem to be a simple answer for him other than the inversion technique, or possibly allowing additional bit spacing.

William H. Eburn, Jr. WA1OPR
Westport CT

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Caveat Emptor?

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8 EL. 6M. BEAMS. A/S HM 171 Reg. List $109.95. Close out price $29.95. F.O.B. Cleveland, Ohio. Communication World, 4788 State Road, Cleveland, Ohio 44109.

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	1	2	3	4	5	6
$\boxed{7}$	$\boxed{8}$	9	10	$\boxed{11}$	$\boxed{12}$	$\boxed{13}$
$\boxed{14}$	15	16	17	18	19	20
21	22	23	24	$\boxed{25}$	$\boxed{26}$	$\boxed{27}$
28	29	30	31			

Possible aurora 9 and 10

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	3A	3A	3A	3A	3A	7	7A	14	14
ARGENTINA	7A	7	7	7	7	7	14	14	14A	14A	21	21
AUSTRALIA	14	7B	7B	7B	7	7	7	7	14	14	14	14A
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	3A	3A	3	3	3A	7A	14A	14A	14	7	7
HAWAII	14	7B	7	7	7	7	3A	3A	7B	14	21	21
INDIA	3A	7	7B	3B	3B	3B	7A	7A	7B	7B	7	7
JAPAN	14	7B	7B	3A	3A	3A	3	7	7	3B	7B	7
MEXICO	14	7	7	7	7	7	7	14	21	21	21	14
PHILIPPINES	7	7B	7B	3B	3B	3B	3A	7	7	7B	3B	3B
PUERTO RICO	7	7	7	7	7	3	7	14	14	14A	14A	14
SOUTH AFRICA	7	7	7	7	7B	7B	14	21	21	14A	14	14
U. S. S. R.	3A	3A	3A	3	3	3A	7B	14	14	7B	7B	3A
WEST COAST	14	7	7	7	7	7	3	7	14	21	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3A	3A	3A	3A	3A	7	14	14	14
ARGENTINA	14	7	7	7	7	7	7	14	14A	14A	21	21
AUSTRALIA	14A	14	7B	7B	7	7	7	7	14	14	14	14A
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	3	3	3A	7	14	14	14	7B	7
HAWAII	14A	14	7	7	7	7	7	3A	7	14	21	21
INDIA	3A	7	7B	3B	3B	3B	7	7	7	7B	7B	7B
JAPAN	14	7B	7	3A	3A	3A	3	3A	7	3B	7B	14
MEXICO	14	7	7	7	7	7	3	7	14	14	14	14
PHILIPPINES	14	7B	7B	3B	3B	3B	3A	3A	7	7	3B	7
PUERTO RICO	14	7	7	7	7	3A	7	14	21	14A	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	21	14A	14	14
U. S. S. R.	3A	3A	3A	3	3	3	3	7A	7A	7B	3B	3B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	3A	7	14	14
ARGENTINA	14A	14	7	7	7	7	7	7A	14	14A	21	21
AUSTRALIA	21	21	14	7B	7	7	7	7	7	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	7A	21	21	21	21
ENGLAND	7	7	7	3	3	3	3	7	14	14	7B	7B
HAWAII	21	14A	14	7	7	7	7	3A	7	14	21	21
INDIA	3B	14	7B	3B	3B	3B	3A	3A	7	7	7B	7B
JAPAN	14A	14	7B	3A	3A	3A	3	3A	7	3B	7	14
MEXICO	14	7	7	7	7	7	3A	7	14	14	21	14
PHILIPPINES	21	14	7B	3B	3B	3	3	3	7	7	3B	14
PUERTO RICO	14	7	7	7	7	7	7	14	21	21	21	14A
SOUTH AFRICA	14	7	7	7	7B	7B	3B	7B	14	14A	14A	14
U. S. S. R.	3A	3A	3A	3	3	3B	3B	7	7	7	3B	3B
EAST COAST	14	7	7	7	7	7	3	7	14	21	21	21

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 magazine for radio amateurs

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February 1973
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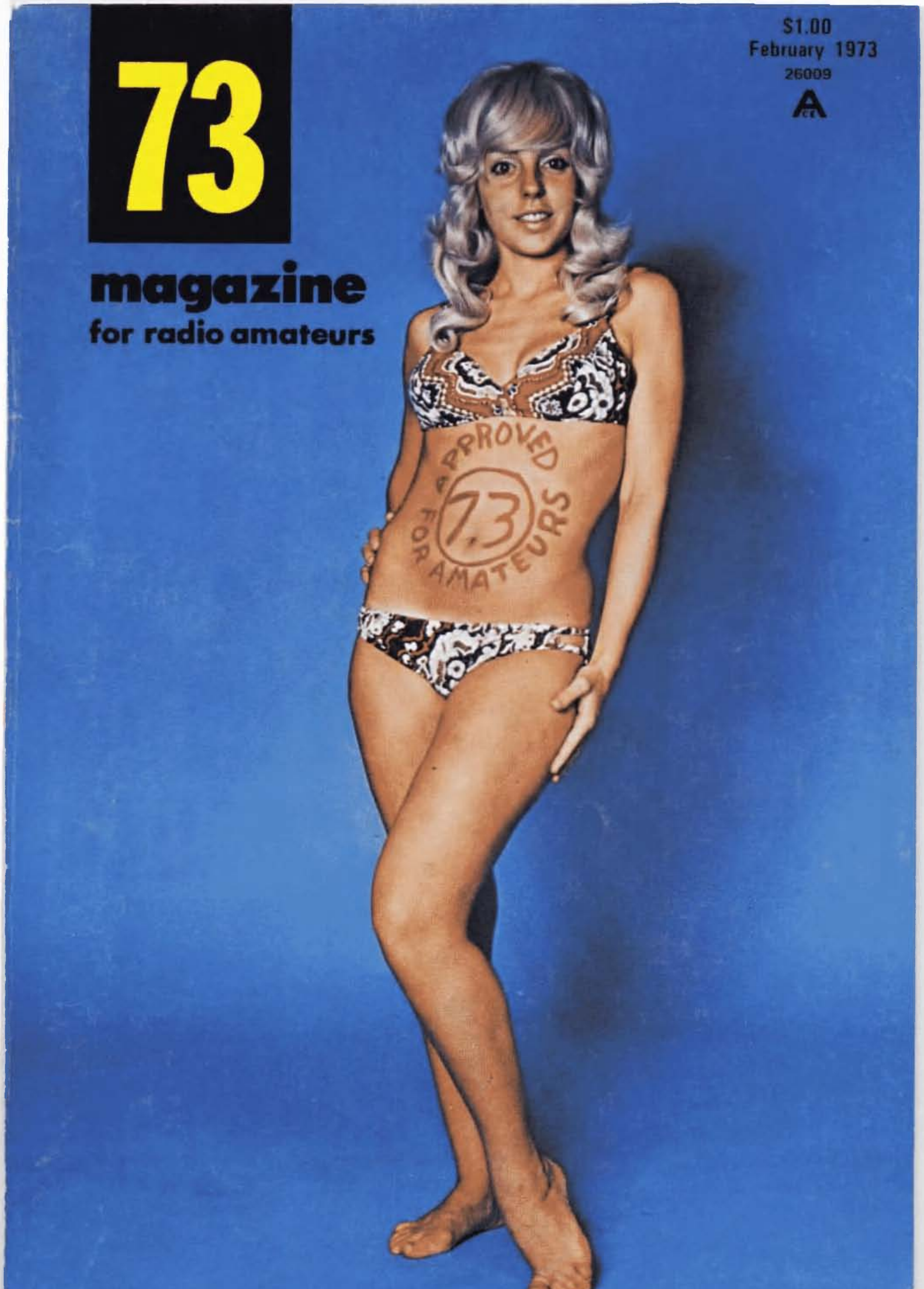

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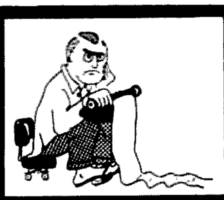
COVER: Apropos of St. Valentine's Day, we have Judi Light encovered — or perhaps uncovered. Repeater Bulletin readers know her as Judi Repeater. The photographer on the "work is fun" project was Charles Webb K0BWR and those of us who appreciate fine construction projects thank him for making the effort. Perhaps some of you budding photographers out there will win your way into the heart of a nice YL and provide us with an amateur radio or 73 slanted picture.

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year in North America and U.S. Zip Code areas overseas. $7 per year elsewhere. Two years $11 and $12 overseas. Three years, $15, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A.



NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

ONE MEG THOUGHTS

The new regulations have had quite an impact on repeater operations. The complexity of getting repeater licenses have noticeably slowed down the appearance of new repeaters on the two meter band – as well as on 220 MHz. But most repeater groups are in agreement that this is a temporary slowdown and that there will be a big need for more channels before long.

The opening of the 147 MHz segment made a bunch more channels available, but it also made a one MHz split feasible for the first time, and the benefits of this have caused quite a bit of brow knitting.

If we leave the 146 part of the band as it was we have fourteen repeater channels and six simplex channels, figuring the standard 600 kHz split. There are thirteen repeater channels and seven simplex channels in the 147 MHz segment, a total for the two megs of 27 repeater channels and 13 simplex.

Now, since repeaters have been forbidden to operate in the 144–146 MHz part of the band, it would seem reasonable to try to encourage simplex to use these channels and thus permit repeaters to have all of the channels possible in the band segment to which they are restricted. Since, in most areas of the country, simplex operation accounts for perhaps 5% of the total FM activity, the allocation of one third of the channels for simplex would seem seriously unbalanced. In fact, simplex activity rarely occupies more than one or two channels in any area and the allowance of 13 channels is enormously wasteful as far as repeaters are concerned.

If the simplex channels were all turned into repeater channels, this would add six more repeaters, a total of 33. This should be enough for all but the most urban of areas such as the eastern megalopolis.

While 33 channels may indeed be enough even for New York City, the consequences of there being a need for more than 33 are dire. Before the 147 meg segment opened there were more repeaters than available channels and new groups began filling in between the standard channels, with mixed results. Some receivers are capable of handling the problem of a repeater just 15 kHz away, but not many.

The channel splits in the early FM days were set up as 60 kHz. This permitted six repeaters in the meg. It didn't take long at all for the six channels to fill up and the next step was the logical one of splitting into 30 kHz channels. It was logical, but it was wasteful and set up a problem for those coming along a couple of years later when the only remaining split left was to 15 kHz.

Technically, it is a lot easier to make receivers which will work reasonably well with repeater chanels 20 kHz apart than it is 15 kHz. A whole lot easier.

With this situation in mind, many of the proponents of reestablishing repeater channel standards favor not only a one meg split, but also a change to 20 kHz between channels at the same time. With some repeater groups still struggling into the 600 kHz split standard, it is difficult to engross everyone in the benefits of making such a major change just a year after we all finally accepted 600 kHz. A few of us point out that we tried to sell the one meg idea a year ago when 600 kHz was coming to be accepted, but were shouted down. No matter, this is 1973 and things are different today than they were just a year ago. Crystals are much cheaper – synthesizers are a reality – and we have learned that change is not all that big a deal.

Proponents of one meg splits point out that this would solve several serious problems. First of all it would greatly simplify the construction of repeaters – and would enable most repeaters to work a lot better than they do today. Few repeaters do not suffer from desensitization to some degree. Further, now that mobile and base station rigs are asked to transmit over a two MHz range, the efficiency of most of them drops off seriously on either one end of the band or the other.

Transceivers must transmit from 146.01 to 146.40 in the lower MHz and 147.63 to 147.99 in the upper meg. Not many can handle that. The receiver is not strained as much, having only to cover one meg. In areas where the 147 meg part of the band is set up with input low and output high, like the 146 band, the receiver has to cover 1.5 MHz and so does the transmitter! Add to that almost insurmountable intermod problems which result from this system and you have headaches of major proportions.

If we decide to put all our repeater inputs in the 146 segment we ask our transmitters to cover only 1 MHz – ditto our receivers. It's easier. Intermod is greatly reduced too. It would only take a slight stretch to add some simplex channels below 146 on transmit.

If we also decide to change to 20 kHz spacing we will have a total of 50 repeater channels available. Since this would include all of the original 60 kHz channels, on which most of the larger repeaters are settled, it would not cause serious problems to very many operators. Repeaters would be on every even channel starting at 146.00–146.02, etc.

It may just be time for repeater councils to start talking about this and see what can be done. The one meg split talk is gathering momentum and we all have to face the prospect that it might be with us a lot sooner than seems possible. The fact is that several repeater groups have already announced their intention to go one meg – and if we are all to get in step and arrange for mutually acceptable standards we have to put aside those who oppose change and see what can be done to accommodate it.

If we don't agree, we will be faced with the prospect of some repeaters going 20 kHz channels, some 15 kHz, some input low, others input high. We do need to get together.

What about this business of moving from 30 kHz channels to 20? Some rigs will swing that much on transmit – some may require a padding capacitor. Others may not make it and it may be necessary to send the crystal back for a slight shove. I suggest that we try to always move down as this is where added capacity moves crystals. Thus a repeater input on 146.07 would move 146.06. It apparently is not a big or expensive deal to get crystals moved a few kHz. During a change it would be possible for many repeaters to run two outputs for a month or so while users got new receive crystals. By staggering this operation the spare transmitter could be used for one month with one repeater and then moved to another for the next month – etc.

Needless to say, 73 will welcome any and all ideas on repeater standards. We are not really interested in emotional harangues, but would like

to pass along any well reasoned arguments and suggestions.

REPEATER LICENSES

Firstly, to establish my bona fides – the following is what I managed to glean from an all-day confab with the FCC (amateur division) in Washington. Hopefully I have not screwed it up too much.

The fact emerged that repeater licenses are going to be a lot more difficult to get than most repeater clubs realize – if they insist on going for a license for their complete system right off the bat. As the complexities of providing satisfactory information on the many aspects of the license grew more apparent to me, the direction in which a solution to this maze lay became more obvious.

Let's take the complexities from the top and make you wait, if this problem interests you, for the easy out.

Take docket 18803 firmly in hand and turn your attention to part 97.41(f), the application for a repeater license. You will find this on page 106 of the November 73.

(1) The docket requests that the location of the repeater be drawn upon a 1:250,000 scale topographical map, one with 50 foot contour lines. These maps are available from the U.S. Geological Survey, Washington, DC 20242 for $1.50 each and they are extremely difficult to find anywhere else. You will find an index to some of these maps published in the March 1970 issue of 73 on page 94. The maps use the same numbering system as the three dimensional maps. The FCC wants these particular maps used and *no* others. Yes, they know that the more available 1:62,500 maps give more detail and are "better." They want what they specified.

(2) They would like you to show your computations for determining antenna height above average terrain. See appendix 5 on page 112 of the November 73.

(3) Your effective radiated power will be the transmitter output less the loss in your feedline (see the 73 Coax book for details on coax losses by type of cable, frequency and length) and less any radiation in other than the main lobe. You may find that you will have to consult "Antennas" by Krauss or stick to something simple in an antenna such as a dipole. If you are going to use anything more complicated than a half wave dipole you should show the mathematical derivation of the power in the horizontal plane main lobe and also show evidence that you have confirmed this figure by actual measurement.

(4) The manufacturer's rating of output is not sufficient here – show that you have actually measured it with reasonably precise equipment.

(5) The transmission line loss will be the same as used for your calculations in (3). Give the theoretical loss and show that you have verified this by actual measurement.

(6) The patterns as published by the antenna manufacturers are not sufficient to get you through this part – unless the manufacturer has had the patterns of radiation accepted by the Chief (amateur division) of the FCC. None have as yet. If you do use the manufacturer's patterns you must indicate how they were determined – whether by mathematical derivation or range – whether they were checked on a range and the characteristics of the range used. If you made the patterns yourself you should give data on the methods you used.

(7) More of same.

(8) (9) Forget these for now – they're too much to cover in less than a book.

The obvious answer

Since the problem facing most repeater groups is an immediate one: to get licensed as quickly as possible – and with the deadline approaching when repeaters will have to be shut down unless some sort of WR- license is in hand, the path of least resistance would seem to be to simplify the application to the barest bones for a starter and then add complications to it once the license has been obtained. This makes sense, doesn't it?

Since it is possible to get shot down for the whole license on any one of the details, the route of extreme simplification seems best. If you think in those terms the repeater license gets a whole lot easier to work on.

How can you simplify the application? Well, if you get your license first for direct local control, you will avoid a vast number of complications, any of which could bounce your application back. This immediately deletes (8) and (9) as problems. If you put down that you will start with a dipole you avoid all those patterns and the complications of the gain of collinear antennas. The pattern is ultra simple – see page 8 of the VHF Antenna Handbook by 73 Magazine (S3) for the vertical and horizontal pattern of a vertical dipole. For some reason the amateur handbooks do not give these patterns. That's a "tsk" for ARRL and Sams.

If you use foam RG-8/U you have a loss of about 2.3 dB per 100 feet at 146 MHz. The chart on page 13 of the Coax handbook shows that a 2.3 dB loss is equal to a power ratio of 0.588. If you put ten watts in the bottom you will then get 5.9 watts out the top of the feedline. If you are using a dipole (gain of 1) this will give you an effective radiated power of 5.9 watts.

Once you have that elusive WR- call in hand (none have been approved as of this writing) you can go ahead and modify for your big antenna. With that okayed you can go to perhaps a phone line remote control – then on to a 450 link – and work on into proposals for automatic control or whatever turns you (and the repeater) on.

The Repeater Bulletin provides a faster communication medium for repeater news and this situation will be covered at far greater length in that publication – still available for $2 per year from 73. The December issue of the Bulletin carried the latest available FCC helpful hints for getting your repeater license and further editions of that poop sheet will be published in the Bulletin.

FCC vs CBer

The report that the FCC monitoring stations had issued more citations to hams last year than to CBers makes it rather obvious that the FCC just isn't even trying to solve the mess on 27 MHz.

Some people are of the opinion that it is the magnitude of the mess that has stopped the FCC from even making a serious attempt at cleaning it up, but that does not make real sense. The fact is that if the FCC had any serious desires to get the CBers into shape they could do it with little effort and expense.

How? There are a hundred thousand or so amateurs who would gladly pitch in and help. With even the slightest hint, amateurs would work up direction-finding teams and hunt down the illegal operators, presenting the FCC with the names, addresses, illegal calls, etc., of the pirates. Amateurs are well aware that the lack of distinction between amateur and CB has caused much trouble for radio amateurs. Few of the newspapers seem to have any idea that a CBer is not a ham, so whenever a CBer does something so raunchy that it makes the papers he is often as not billed as a ham. Hams would be only too delighted to help clean up this cancer.

Why is it that the FCC has made no noticeable effort to clean up this problem? Is it the power of the EIA Washington lobby that has them backed off? Money talks, and it may be speaking loud and clear in this case. How else can we try to understand the present situation wherein there is an obscene mess on eleven meters – little is done about it – and now there is very serious talk of giving this bunch

of illegal idiots another 80 channels?

I would like to tender an abject apology to any law abiding CBer who is actually on the air and using the band as it was intended. While I recognize that there is a remote possibility of such a person existing – he is remote enough so I don't know where he is. He is also totally covered up 24 hours a day by Red Apple and his ilk.

TUNING CB RIGS

The fact is that CB transceivers have a tendency to go out of tune quite a lot with a resultant loss of power on both receive and transmit. This is due to several factors – changes in temperature can have a profound effect on some of the parts such as i-f transformers and can loosen the little screws which hold them together. Once these come loose their operation can be seriously degraded.

Vibration during use and in shipping often loosens these screws, not only on i-f transformers, but also in crystal oscillator circuits.

Though it is not legal for a CBer to mess with his own set, it is not all that difficult for him to get a small screw driver and tighten all of the loose screws and thus bring the set back to the way it was when shipped from the factory.

Once the screws on the i-f's and padders have been tightened, the average CBer will be better able to operate his rig and observe the FCC regulations.

FM = FUN MAKER?

If it were not for the number of FMers who personally thank me on the air and at conventions for urging them into FM I might just stop poking those of you not yet on FM in the sore spot. But the fact is that there is a lot of fun that is being missed by tens of thousands of ops – inexpensive fun.

The complaint that I hear most from low banders who have not yet tried FM is that it is just another citizens band. I even hear this now and then from someone who has listened to it for a few minutes from a store or from a friend's house. I don't think you'll find any active FMers who will back up that evaluation.

Anyone who checked out FM in Southern California up until recently would have reason to wonder what all the fuss was about. There was a lot of the CB-type stuff going on, with Broderick Crawford ten signals, virtually no rag chewing, and darned little meaningful communications.

There are peculiar problems here and there around the country, to be sure. But in all, if you get more than one or two sets of crystals for your FM rig, you will find as nice a group of people to talk with you as you could possibly ask for.

Up here in New England I can name maybe a half dozen over-inflated ego cases that are a minus quantity on FM – and for every one of these dingalings I can name ten nice decent interesting FMers. For every bad mouther of FM there are a hundred or more fellows who will go way out of their way to be of any help they can.

When the president of a repeater club turns out to be the one jamming the club station, we have some problems. When the editor of a repeater council newsletter goes on the air and expresses disgust with FM, we have problems. But these are the problems of a couple individuals and they are insignificant. They are ego difficulties – and until the FCC decides to include a psychiatric exam with the license test, we must accept the bad apples along with the good – and try to ignore the bad.

My discussion of the bad aspects is all out of proportion to their importance. The average FMer rarely runs into them and FM is for almost everyone a joy. FM provides the truely interference-free contact that we find so rarely on the low bands. It provides you with a small group of not very distant friends with whom you can talk, joke, visit, help, and be with on the air whenever you have a free moment. You can be with them while you are taking your children to school – while driving to work – while driving to a customer – any time. You can have a hand unit and be on call whenever you are awake if that turns you on.

When you travel you have an immediate intro to the FMers anywhere – and you will find them most gracious. W1QXR steered my wife and me to one of the finest restaurants in the country one evening when I was driving through Bangor. Every FMer has had experiences like this – by the dozens.

And what a good feeling it gives you when you are able to provide a public service! The other night I was driving from New York to New Hampshire and the road conditions were execrable. It was snowing and raining, with the rain freezing the road into a sheet of ice and the cars were being frosted over. Cars were sliding off the road everywhere. Whenever I would see one that obviously couldn't get back on the road I would pass the word to the highway patrol via the nearest repeater. I reported six such accidents during my trip. None of those people will know who sent help, but they will appreciate it.

What do we talk about on FM? Anything and everything. Since the contacts are QRM-free, we can get into real conversations and are not limited to name and location as on the low bands. And since we generally get to know most of the regular inhabitants of the repeaters we use, we have more and more to talk about.

Well, enough of the sales talk on FM. Check around and you'll find that there are a number of active FMers in your area – talk with them – and you'll be getting a rig soon.

SECURITY COLUMN?

Unless I get an awful lot of static, I would like to devote a small space in 73 every now and then to keeping readers up to date on equipment and literature available for security involved amateurs. If there is anyone among our readers who is well versed in the field and would be interested in keeping us all informed, I'd like to hear from him.

While some readers have all the money they need and the price of a Signal One is no problem – the sad fact is that most of us would like to have an extra couple hundred dollars a week coming in. It is just a lot further between times we can buy a new rig or a hand unit that we really like.

ARTICLE IDEAS

Hundreds of rigs are stolen out of cars every year – and the situation is getting nothing but worse. What can be done about this?

We have already asked for articles on car burglar alarms – and frankly we would like to have a lot more sent in to be published – but we haven't seen much in the way of new ideas.

Now that more and more of us are packing a hand unit when we leave our car we might be able to put it to good use. Suppose we set up a circuit that not only set off an alarm when someone tampered with the car, but also sent out a signal on two meters that we could receive on our pocket unit? Most of the time you are not all that far from the car and would be able to zip out and collar the kid who is busy ripping you off.

This would be valuable even at home – and a lot of gear is swiped out of cars parked in front of the house or even in the garage.

Let's see some articles on this.

The new VWs have a plug built in for hooking into a "computer" at your local friendly Teutonic service center. This plug connects to sensors spread all through the car, keeping touch with each pulse. Some of these might be of interest to us to monitor – like for instance the battery water level. Be assured that the editorial staff of 73 will not look too

Continued on page 22

SSTV SCENE

Dave Ingram K4TWJ
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As you know, Slow Scan activity is growing tremendously, and 1973 promises to be the biggest year yet. (Wait 'til you see all the new gear and SSTV info coming out this year!) This is really great; however, we "modern day pioneers" are now realizing "growing pains" similar to the SSB activity in the early 50's. The increasing number of active Slow Scan stations now call for a review of such matters as identification methods and worldwide calling frequencies, for example. Maybe we should consider video and audio ID every three minutes mandatory. Possibly we should move our favorite "hangout" frequency of 14230 kHz to 14250 kHz, and start stacking back toward 14230 kHz as Slow Scan activity increases. This would serve the double purpose of easing some pressures between SSB DXers and Slow Scanners, plus giving us room for future expansion. Cop Macdonald and I feel through a unified effort these issues can easily and quickly be resolved. What's your opinion? If you have any ideas, or suggestions, we would be quite interested in hearing from you – and soon!

Orbit 418 (11/18/72 GMT)

Gene W8YEK is up to 64 countries on SSTV now, and W4MS is right behind. Two ET3's just got on SSTV, ditto a DU1. Remember Bill XW8AX? He's now back on Slow Scan as TJ1AX. Look for him around 21340 kHz, about 1900 to 2000 GMT. VU25KV has been running some good pictures out of India lately . . . the usual frequencies, 15 and 20 meters. Two DX "goodies" appeared on Slow Scan for about a week during November, 5W1AT and an HSØ. Both operated on 21340 kHz about 2000 GMT. Hmmm, new trend here . . . or is 20 meters just getting too rough?

The WA9UHV/W9NTP QSO's through Oscar VI continue to grow in success. This month's pictures from WA9UHV should illustrate this. If you hold the photo out at arms length the QSB won't be too noticeable. Although a complete description of these guys' work and rigs would take a full column, I think it would be sufficient for now to say WA9UHV uses a transverter, some beams, all home-brew Slow Scan gear, and a Signal One transceiver. W9NTP's rig is so large – I'll just have a picture or two in next month's column!

Orbit 418 (11/18/72 GMT)

Sometime back, Mike Tallent W6MXV and Don Miller W9NTP, came up with the idea of transmitting two regular, 120 line, Slow Scan pictures of an object, and shifting the second picture ever so slightly, so its 120 lines would fill "in between" the previous pictures 120 lines. If the two pictures (or Frames, as they should more properly be termed) were then viewed simultaneously, the result would be a high resolution, 240 line Slow Scan picture. To accomplish this, you simply take a photograph off the screen, and leave the shutter open for both frames, or 16 seconds. The only requirement of your monitor for this "interlaced" system is that focus can be adjusted sharp enough each line, and space between each line is clearly visible. (You can't fill in a space that's not there.) Your Slow Scan generator can probably be modified, inexpensively, to obtain the simple sync generator shift. Robert Suding WØLMD, took the sequential interlaced frames a step further in his sync generator modification and has selectable 120, 240 or 480 line picture capabilities. I found his circuit quite interesting since the cost is very low. W6MXV, W9NTP, and WØLMD will probably hve copies of these circuits at the Dayton Hamfest in April – however, if you can't wait, send WØLMD an SASE and 10 cents (to cover Xerox cost) for a copy.

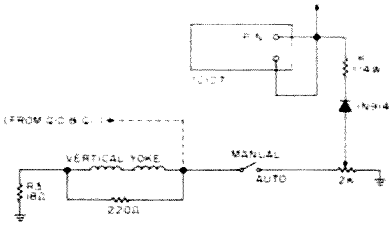


Fig. 1. Automatic vertical reset modification.

Those of you with W6MXV monitors might be interested in Fig. 1, a modification for automatic vertical reset (constant running sweep). The switch selects manual vertical trigger, or automatic reset.

You might use Pin 12 (that previously unused pin) on the monitor circuit board to bring out the lead from IC 107. A simple modification to make a great monitor even better!

Don't forget the Slow Scan contest the 10th and 18th of this month. Hope to be "seeing" you then . . .

73 . . . Dave, K4TWJ

SUMMER E SEASON REPORT

The last half of June along with July and August seem to have been very active with not only aurora and E's, but with continued F2 contacts as well. There seems to have been a lot of activity in the Caribbean area. A number of stations, from all sections of the United States, worked VP5RS, 8P6EN, and a host of KP4's. August seems like an interesting month for Jack K2KDQ. He told of hearing a pair of KH6's in QSO. When Jack tried to break in, one of the stations came back to him and said "K2 . . . " Unfortunately, the band gave out and they were never heard from again.

Meteor scatter DX'ers take note: W2AZL, Holmdel, N.J. and WØLER, Minneapolis, Minn., made the first meteor scatter two-way on 432 on August 12th. It took them over five hours to complete the two-way, proving once again that patience pays off! I thought I might mention this fantastic achievement even though it is not really related to the E season. One of the greatest auroras of all time occurred between August 3–5th, when 50 through 432 were wide open. I had an eyeball with one of the members of the WA1MUG group at

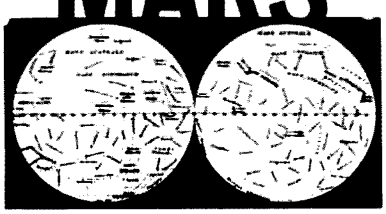
the Hudson Division Convention back in October. He told me that if I thought the June contest was bad, I should have operated the September contest. It was completely lacking in E's.

Mel Wilson, W2BOC, a VHF propagation enthusiast for almost 40 years, sent the following comments:

"The only comments I could make at this time is that the summer was a 'good' one in the sense that the MUF was up to at least 180 MHz and the two meter band was open a number of times. From 6 May to 13 August, there were 7 days in which I have no reports of VHF propagation, not counting 3 days of aurora which of course blanks out intense E's. This number of days is about average for each year. However, this year the length of openings was somewhat greater, the geographic area seems to have been greater, and the openings at more northern latitudes were better. The year started earlier, with very unusual intense openings during the first week of March, with the MUF at least to 100 MHz. Beyond that I don't know of anything else very unusual. I have no reports of KH6 being heard east of the Mississippi, which is surprising with so much intense E's. There have been some rather wild reports, but they haven't checked out."

Bob Scupp WA2CXS
Reprinted from the **Knight** Knews.

MARS



Harry Simpson A4SCF
c/o 73 Magazine
Peterborough NH 03458

Orchids to AFC6YPX, the North American Rockwell Radio Club station located in Anaheim, California, on their fine bulletin written especially for the benefit of their fellow AF MARS operators in Southeast Asia. To quote: "We are located at North American Rockwell's Electronics Group where approximately 12,000 are employed. Our station is at the Employees Recreation Park just outside the main plant premises. The park comprises 20 acres and has a picnic area, a nine hole golf course, exercise room and various club rooms . . . antennas overlook right field on one of the ball diamonds and our log periodic is adjacent to the tennis courts and swimming pool – still it seems that we spend all our time in the Radio Club operating MARS!"

This very fine station, which my informant says handles more Southeastern Asian phone patches than any other known station, is well equipped with the most modem gear – including a wind-sensing circuit which automatically lowers their towers from 75 to 25 feet whenever high winds come up!

A welcome letter from Hugh Dowell NØASG3/NØKXW, Assistant to the Director for Operations, Ninth NAVMARCORMARS. District, outlining Navy MARS procedure which, if adopted by the other services, would be a boon to the overall program. He says, ". . . a number of hams join MARS with the idea of getting free equipment. You probably know as well as I do what happens to these would-be members! Navy MARS has changed their policy toward new members recently. We are looking for members who will be active and are trying to weed out the others. When a person joins Navy MARS he is given a four-letter suffix call sign (example – NØBAT) and is considered a temporary member for 90 days. At the end of that period, if he has met the minimum participation requirement of 18 hours per quarter he is recommended by his area coordinator to the District Director to be accepted as a full member. If he has not met the requirements he is terminated. This method allows us to assign new member calls much faster than before, cut down unnecessary paperwork, etc. If the new member is recommended, the "T" in his call sign is dropped and he has a standard call sign." Thanks, Hugh, for your wonderful letter and the information.

Thanks also to Sam Dunn WB4ICF/NØJXG for filling us in on Marine Corps MARS activity in the Okinawa area – there are 5 stations on the island, plus one in Japan. Each station is manned only by qualified MARS operators with a MOS of 8981, and also must be a licensed amateur! A very nice letter from Shorty Sutter AFA9YBM, offering the information that in Air Force MARS a W prefix is changed to AF; K is AFA, WA is AFB and WB is AFC. I would like to acknowledge many, many other nice letters – unfortunately my space is severely limited (we're proud of even the limited space, Wayne!). Suffice it to say that thanks to your response, I can now forward inquiries for a particular MARS service directly to the proper person. To the few who wrote nasty letters about my not mentioning their service – yet who didn't offer one iota of information on same – I can only quote an old friend, "You ain't a solution – you're part of the problem!" Just keep those cards and letters coming in – we'll make a worthwhile column yet!

. . .A4SCF

HAMS LOCATE MEDICATION

On August 15, 1972 10 GMT Hildegard I8PLH from Reggio Calabria made a call on 80m for medication (Gamma Globuline). A child in the Clinica pediatrica in Roma was sick and needed it desperately. All commercial ways were exhausted or did not work, since there was a big church holiday in Italy.

Hannes DK1KQ from Lindau/Bodensee picked up the call and said he would be back at 10:30 GMT. Now Traudl DK1AX from Miesbach near Munich called I8PLH asking if she could help and also asking about the Maiory YL RC Italiano Meeting, where she will represent the DL YL's. Since DK1KQ could not come back at the stated time, Traudl called DC2CG, Dr. Friedrich, in Munich. He had the proper medicine. It is very expensive and not common in that area; he had wanted to donate it to a missionary for some time. Traudl made the arrangements with Lufthansa, the German airline, to fly the medication at 13:40 GMT to Roma, while Hildegard contacted the police to have it picked up at the airport by a patrol car. It was all settled at 11:54 GMT.

At this point Hannes DK1KQ came back. He must have had a tough time in between, but he found some of the medicine, too. Since there is no commercial airport in Lindau, the German Air Force flew the medicine to Roma, where another patrol car was waiting for it.

Now the medication for the child was secured for two days. After that, slow (on holidays slower) working commercial channels could take over.

Traudl DK1AX was instrumental in helping to locate the medication.

DX FOOTNOTES

Gus Browning W4BPD
Drawer DX
Cordova SC 29039

Here goes my second month as DX Editor for 73 Magazine. I hope by now that all you DX'ers out there will have the "message" and start sending me (direct if possible) all the DX news you come across. Keep in mind that I have a lead date of 2 months. Of course I can and WILL use the info that would be too late for this magazine in my weekly DX'-ers Magazine. In advance I would like to thank you for your efforts.

As you know those sun spots are getting less and less, so you may as well kiss 10 goodbye, and not expect those "almost" around the clock 15 meter openings. You had better be getting ready for the low bands and a new form of excitement that goes with working DX down there. No big, fancy, high power is needed (or allowed) on 160 meters you know. Nothing fancy in the form of antennas is needed either. I had a picture of a chap in Western Australia who had his "long wire" (?), strung along his wooden fence around his home ! I understand that he has been doing extremely well with it too. I guess you could call it his invisable antenna because when you look at the thing it certainly don't look like any antenna I have even seen - Sort of like an extra clothes line - yes, but not an antenna !

Right about now is a good time to be getting on 160 with QRN way-down, and activity up. Remember this band is at its best when its sunset or sunrise on one end, but you gotta get in there fast, because its short and sweet. The band has some other odd features which you will find out when you get going there. *I* once made WAS on 160 meters on two weekends. Of course that was when we had the whole band from 1750 to 2000 kc. Maybe *if* enough fellows get on this band and do a little real complaining to FCC they will get that darn Loran off for sure and start using some of these new DF's I have been reading and hearing about in recent years AND then give us back "our band". Let's us all hope.

It seems that we have at last got some little activity going in the AC Spots (as I used to call them). The Maharaja of Sikkim gets on once in a while signing AC3PT (The PT is a part of his initials), usually on 20 SSB and just occasionaly on 15 SSB. No need to look for him on CW because when I was there he was not copying CW and knowing what a busy man he is I seriously doubt *if* he has had the time to learn the code since then. At present Bhutan (ex-AC5-land) has two stations that can be worked *if* you are "persistant", and really "go after them" and have a certain amount of good luck or have someone to "fix you up" with a few firm schedules. At least it seems as if I did leave a small "seed" about ham radio in that area. I did sell the Collins "S" line and a 30L1 and even a Telrex and Ham-M rotar to AC3PT. I understand the Hallicrafters SR150 that I left in Bhutan is the Transceiver they are using now. If it is let me tell you that the "RIT" tuning has been changed so that it will only tune "up", not down from the transmitting frequency, in fact as much as maybe 15 kc as near as I can remember. You might keep this in mind if you hear him working stations off his frequency.

HEY THERE YOU DX CLUBS !!! We want you !!! We would like to "appoint" one DX (or at least DX minded) Club in each of the USA call areas, and one DX Club in each country in the world to act as verification points for our WTW Awards. We do not want any DXer to have to send us his cards to be checked. You run the chance of them getting lost and its that much more "work" for us here ! (we are basically lazy). For the time being we are using the the ARRL Country list, BUT we do have some ideas of some (but only a few) changes in their "official" list. We WANT MORE COUNTRIES, not LESS and we have our ears and eyes open to any and all suggestions from DXers here in the USA or anywhere else in the world. We want DXers to have something to do since this will keep them busy and out of "trouble" and keep the bands busy so that some other "service" wont steal any more of our "living space" !

If you have not as yet received your OJØ QSL you might try again now because they are being mailed out and *you* should have received yours by this time. The same goes for cards for those who worked TI9C. (send your cards via TI2GI for TI9C). If you worked HH9DL some months ago you might try W3HIZ (I printed the cards for W3HIZ in early Dec.

In case some of you don't know about our 73 - 73 - 73 DX Award, here is the info again: Work 73 different countries in the first 73 days of 1973, make a list of the stations, giving the dates, times and freqs of each QSO, get a few hams to verify (let 'em look over your cards, or at least your log) and tell us you are OK, then send the whole mess to us (the whole mess being the verified list - YOU KEEP YOUR CARDS (if you have them !). We'll do the rest. In case you don't know it 1973 is 73 Magazine Year. This is a historical fact and cannot be denied by anyone. If you don't believe me just ask Wayne Green and I am sure he will verify this fact.

Ever want to hear *about* what's new in DX ? Try listening on 14,218 kHz almost any evening between 2300 to 2400 GMT. This is where the INDXA fellows hang out, you might try calling in and if you are lucky (and "skip" is with you) get K3RLY to answer your call. He is a very busy fellow, but will answer you OK if he hears your call. He can usually be counted on to hand out some good DX info, he might even be able to put you on the "list" if one is being made up for some DX station. You know some DX stations are very much afraid of a "pile-up", or maybe they just don't know how to handle a "wolf-pack" of callers and they have asked someone like K3RLY to be an MC for them. Maybe they are stuck with just a transceiver and everytime they show up on the band they get "clobbered" with callers. (yes I believe that some fellows, just call and call - never bothering to listen and hear what the DX station has to say !).

Of course there are quite a few other DX Nets in operation, and each of them usually can be counted on to give out some good DX info, or maybe the DX will be in the net ! The SEA (South East Asia) Net usually will have a "goodie" or two calling in. They generally meet above 14300, somewhere around 1230z. Then there is a big DX net with KH6GLU Mc'ing it is called the Pacific (DX ??) Net. Then there is the Arabian Net, in case you want to maybe work The King of Jordan (JY1) or maybe the Queen (JY2). Quite a few "rare ones" call into this net. A few more good nets have sprung to life down in Africa and then there will be found a number of DX Nets being "run" from the USA. ANYONE should be able to work at least 200 countries by checking in just these nets, of course wait until a good chance to "break-in" on them. Back when W1FH, PY2CK, W6AM, W8HGW, W8PQQ, VQ4ERR, VQ4AQ, W4CEN, W4TO, W4TM, W3CRA, myself and many other Ole Timers was battleing it out there was no nets or even DX Magazines (like my DXERS Magazine-a weekly one) to help out DX'ers. You had to just do a lot of "digging, schemeing, writing letters, and most of all "listening".

73 Gus

REPEATER UPDATE

LISTENING
94 76 88 73 70 64 82...

CO	WØIGL	Castle Rock	443.50–448.50
MA	W1BHD	Skunk Hollow	31–91
NY	Delete	Belfry Mt.	444.10–446.18
NY	WA2MBT	Delete	
NY	WA2UYJ	Delete	
NJ	W2BHK	Delete	
NJ	W2FLY	Delete	
NJ	Delete	Cherry Hill	
NJ	Delete	Camden	
NJ	WB2ZQG	South Jersey	22–82
PA	WA3KXI	Lancaster	01–61

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

Early December brought several openings, WA1EXN worked WA5SJM on the 2nd and heard a similar opening to Georgia, Kentucky and Tennessee on the 3rd, this one of 45 minute duration. Also on the 3rd Art worked Dan, WA9UBI, with 5–9 reports both ways. Dan was the only midwestern station heard. WA9YJE was worked under similar circumstances the evening of the 5th; YJE could not hear W1GAO or K1HFK who were in QSO with Art at the time. Art is looking for scatter schedules (random or meteor) in the 20–25 wpm range. Bob, WAØTXV, reports having worked 1's and 2's during the opening of the 2nd. The writer caught openings the 4th and 5th, the first to Florida (W4GDS and WB4OSN) and could hear Jim, WØPFP, slightly on backscatter when he joined in. Bob is already planning another DXpedition for June contest time. The opening of the 5th was mostly 3's working as far West as Oklahoma (WA5RBI) also heard were W5QDB and WB4BBO.

John, WB4RUA, of Calhoun, Georgia writes "re the '50 MHz' column in the December *73*, in answer to Lowell's (WB4WNV) question, yes there is a 6 meter net in North Georgia. The Dixie 6 meter SSB net meets on 50.110 MHz Sunday at 9 AM EST and Wednesday at 9 PM EST. This net is to bring together interested VHF amateurs in the area and provide a clearinghouse for any news and developments concerning VHF. This is a rejuvenation of the same net that sort of died out several months back when the regular NCS had a change in work schedule and could no longer function as NCS. WB4WMT and I are trying to get things back on a regular schedule. We welcome any check-ins and could use more VHF activity in the area."

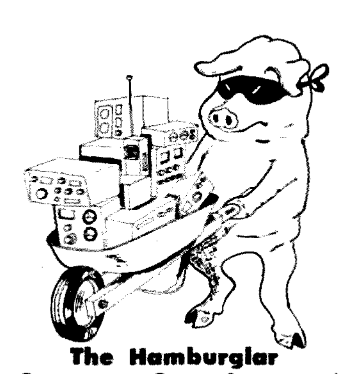
The 19th edition of the Editors and Engineers Radio Handbook is out and while it could use further updating in some areas it does contain much of interest. Much of the construction material is new, several items are must reading for the 6 meter oriented builder. There is a new 2 KW PEP linear featuring the 8877, a solid state exciter by K9HTK/5 covering 6 meters in addition to the HF bands and another in the series of solid state receivers by VE3GFN. (Looks like the perfect i-f for a 6 meter converter.)

A new 6 meter transverter, the CX-6X, has been announced by Signal One. Deliveries are scheduled to begin at about the time this column appears. Preliminary data indicates all mode capability, direct digital frequency readout of both receive and transmit frequencies and compatability with all Signal One transceivers and transmitter/receiver combinations.

Henry Radio has added a new 2 KW PEP linear for 6 and 2 meters to their Tempo line. It is my understanding that this unit is manufactured by E.F. Johnson of 6N2 Thunderbolt fame.

The Annual Conference of the Central States VHF Society for 1973 will be held at the Marriott Inn, Minneapolis the weekend of August 17-18-19. John Fox, WØLER is president of the group, WØMJS is program chairman. Hope to see some of you there.

WAØABI



The Hamburglar
STRIKES AGAIN!

SNEAK-THIEF STEALS FROM CHURCH – Leaves Town Defenseless!

A Clegg 22'er, ser. no. 1900-578, belonging to the Wallingford, Conn. Civil Defense Group was blasphemously ripped from the dashboard of W1NVR's automobile. The sacrilege occurred while said automobile was parked in the parking lot of the Grace Baptist Church on Nov. 20, 1972. If anyone has information concerning the theft, please contact Mike Saul W1DHP, Communications Director, Wallingford CD, 31 Hanover St., Yalesville CT 06492.

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
Yaesu FT-101 No. 107036	WA2YSW	4/72
Standard 2m FM No. 102703	W6NPV	4/72
Drake ML2 No. 20189 33	WB2LLR	4/72
Standard SRC-806M No. 009210	K1TLP	5/72
Aerotone 6M 355LT, No. 685064	RR Police Grd.Ctrl.Trml. NYC	5/72
Standard SRC-806M, No. 102703	C. Mathias 3234 Coronado Ave Imperial Beach CA	5/72
Lafayette HA-410 No. 009210	WA2KDG	5/72
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Swan Cygnet 270,No. 313022	K4ACJ	9/72
Collins Mic, Mod. MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No. M-395430	W8HST	11/72
AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241969	WA2ZBV	1/73

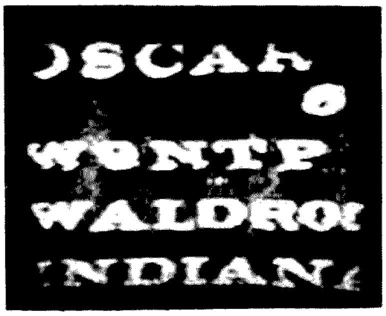
AMSAT NEWS

OSCAR

Mike Frye WB8LBP
640 Dauville Dr.
Dayton OH 45429

Latest news on OSCAR 6; Due to a defective solar panel and because of unexpected use of the on-board translator, OSCAR 6 will be turned off during mid-week. The following schedule will hold to allow time for the batteries to recharge. ON TIMES will be Thursday through Sunday evening passes, and Saturday and Sunday morning passes, unless the batteries are low due to extended use.

ARRL's WA1PID has announced that OSCAR 6 contacts will count in the January VHF contest. ARRL also announces a "Satellite DX Achievement Award," one requiring a 1000-point-or-better total. QSO's through the satellite will count for 10 points, each new country will count for 50 points, and each new continent 250 points. Contacts must take place on or after December 15, 1972, with



only one contact per station regardless of mode. This award only applies to the OSCAR 6 satellite.

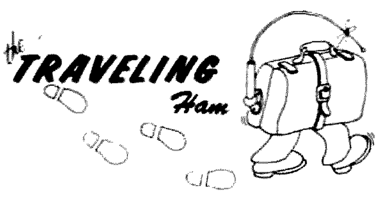
SSTV: The accompanying pictures were taken from OSCAR 6. All photos were transmitted and received by WA9UHV, except the frame sent by W9NTP.

I noticed the clarity and quality of these photographs. This certainly attests to the performance and stabilization of the satellite. Phil Howlett WA9UHV relates that best pictures are received when overhead passes are used. However, acceptable pictures can also be obtained when maximum elevation is 40°. This would appear to be the minimum orbit required for a full 8 second frame. Of course using 2 second frames, a considerably lower elevation is acceptable. Due to the camera used, he was unable to adequately illustrate the gray scale present in the photographs.

More slow scan tests are scheduled to be held in the near future, operating frequencies have been between 29475–29485 kHz.

Now that OSCAR 6 is a definite success, we are faced with a growing problem – *what next?* AMSAT has the next satellite in line, but what will we do with it? After a while QSO's lose some of their excitement. A few people have written in and suggested ideas, and AMSAT is looking them over. A portion of next month's column will be devoted to what is in the future for amateur satellites. If you have any ideas or suggestions of possible experiments, please drop me a line. Thank you.

. . .WB8LBP



Joe Kasser G3ZCZ/W3
1701 East West Highway, Apt. 205
Silver Spring MD 20910.

Well, the scene in England is really humming. I received a letter from G3ZGO full of goodies which are now to be passed on to you.

An FM group has been formed in London. There are over 74 members, and in charge is G5AGX, none other than W8TIF. There are over 120 people in 144.48 MHz FM simplex at the present time.

The only repeater in England is a specially licensed experimental unit in Cambridge. It has a license for one year and then the whole question of repeaters will be considered by the licensing authorities. It is operating on 145.15–145.75 MHz with tone burst access as reported in previous issues of 73.

Slow scan TV is going strong, even the police force are getting in on the fun. The Sussex County police use slow scan for base to mobile communication for passing pictures of suspects quickly, so as to facilitate and speed up the identification process.

It seems that in view of the replanning of the two meter band there may be changes in the simplex frequencies in the early months of 1973.

In Europe, the VHF bands are voluntary planned so that stations in a region occupy a section of the band. Stations in a neighboring region occupy a different part of the band. In this way when an opening occurs, they know where to tune for the DX.

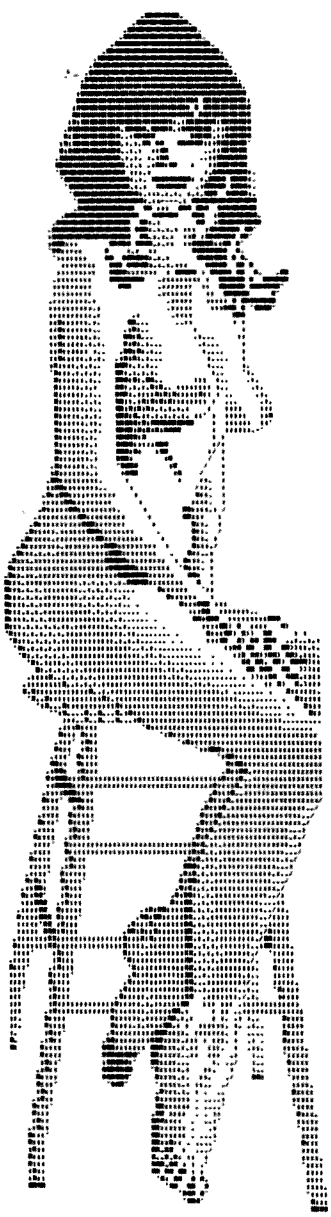
This column has been appearing on and off for a few months now, and I have not had any letters offering ideas. Does that mean that everyone is spending their time at home? If so, then this column will have to cease appearing, so 73 can use the space for something that will be of more interest to the readers. How about a column called "The Homebody Ham?"

What do you do if you need more FM frequencies than your 6 channel rig will allow? Do you put in the most used or wait at each street corner and change continuously? Here in the Washington area we need more than the 6 positions than the usual rig contains, yet a synthesizer is too bulky to carry around. One enterprising fellow carries two rigs.

G3ZCZ/W3

RTTY PICTURE OF THE MONTH!

Want to see your artwork here?



THIRD PARTY REGS EASED DURING HOLIDAYS

Exchanges of third party traffic were temporarily permitted between The Republic of Korea and the United States during the Christmas-New Year Holidays. Phone patches were allowed between HL9 stations in Korea and amateurs in the continental U.S. and its possessions during the period of Dec. 21, 1972 through Jan. 4, 1973. With good results during this period joined with the possibility of easing political tensions, can we expect a more liberal communications agreement with Korea?

SOCIAL EVENTS and CONTESTS

MUSKEGON HAMFEST

The 1973 ARRL Great Lakes Division Convention-Hamfest will be held in Muskegon, Michigan on March 23–24. Ham-Hospitality will be offered at the Ramada Inn on Friday evening the 23rd. Saturday, starting at 8:00 AM, technical sessions, swap & shop, commercial exhibitions and net meetings will be held at Muskegon Community College. More fun at the Ramada Inn that night! Tickets are $2.25. Reservations and info may be had by contacting Muskegon Area ARC, PO Box 691, Muskegon MI 49443 (see their ad on page 119). If you attend you will also be able to meet the gang from 73 . . . we'll be there!

3RD WORLDWIDE SSTV CONTEST

The third worldwide contest for SSTVers is being sponsored by cq electronoca Magazine. The operating times are 1500–2200 GMT Feb. 10, and 0700–1400 GMT Feb. 18. Plan to use all authorized frequencies on 80 through 10 meters. Each two-way exchange counts one point with a multiplier of 10 for each continent and an additional multiplier of 5 for each official ARRL country. The only exception is that each VE and W call area will count as a separate country.

Logs must contain Time (GMT), Frequencies, Data, Call sign, No. sent and received, Country multipliers, Points and final score. They must be received by Prof. Franco Fanti, via A. Dallolio 19, 40139 Bologna Italy before March 20, 1973.

NOTE: All contacts must be made via SSTV *only*. Use of any other mode of transmission before, during or after the Slow Scan exchange is not permitted, and will cause your log to become invalidated.

FOOTHILL HAMFEST

The Foothill High Amateur Radio Club is having its first annual Swapmeet and Hamfest Saturday, Feb. 3, 1973, at Foothill High School, 19251 Dodge Ave., on the corner of Dodge and Newport Ave. It begins at 9 AM to 5 PM. Tickets are 35¢ for adults and 25¢ for children under 12. Booths are $5 each. For more information, call 714/838-7385 between 7 AM and 2:30 PM Monday through Friday.

INTERNATIONAL RECIPROCAL OPERATORS CLUB

A club which supports the establishment of worldwide reciprocal amateur radio privileges has opened its membership to all reciprocal amateurs. Membership is free. Send a copy of your home and foreign reciprocal license with a QSL and two IRC's to IROC, Box 33, Medway, MA USA.

LA PORTE SWAP-FEST

The La Porte, Indiana, Amateur Radio Club will hold its Annual Swap-fest and Auction on Sunday, February 4th, 1973, beginning at Noon, at the Civic Auditorium. There will be talk-in on 94 and on the La Porte Repeater, 22–82. 3910 will also be monitored.

VHF CONTEST

Worlwide VHF Activity 1973 – 3PM local March 10 to 10PM local March 11. Purpose: To keep VHF bands active, allow rig testing, allow hams to get acquainted with fellow VHFers. Exchange call letters, county and state. Count contacts with mobiles in each county worked. Mobiles can work a station once from each county of mobile or portable operation. Let's see some mobiles. Scoring: Multiply number of contacts times number of counties worked times number of states worked. Awards: Certificate to each station scoring 100 points on six or 50 points on two meters. Certificate to the top station in each state regardless of score. This applies to each band of operation. Each band is a separate entry and a station can enter one or both bands. Logs should show time band mode and exchange info. Mail logs by April 15 to WA3NUL, Box 1062, Hagerstown MD 21740.

WHEATON HAMFEST

The Wheaton Community Radio Amateurs will hold their 11th annual Mid-Winter Swap and Shop on Sunday, February 11, 1973 at the DuPage County Fairgrounds, Wheaton, Illinois. Hours: 8:00 AM to 5:00 PM. $1.50 Advance/$2.00 at the door. We are expanding to two buildings this year. Refreshments and unlimited parking. Bring your own tables. Free coffee and donuts 9:00 – 9:30AM Hams, CB'ers, electronic hobbyists, friends and commercial exhibitors are cordially invited. Write W.C.R.A., Bill Rambox, WB9AVD, P.O. Box QSL, Wheaton, Illinois 60187 for information. Please include SASE with ticket requests. NOTE: Ticket prices announced last month in this column were incorrect. The amounts shown above express the actual ticket prices.

1973 IARC PROPAGATION RESEARCH CONTEST

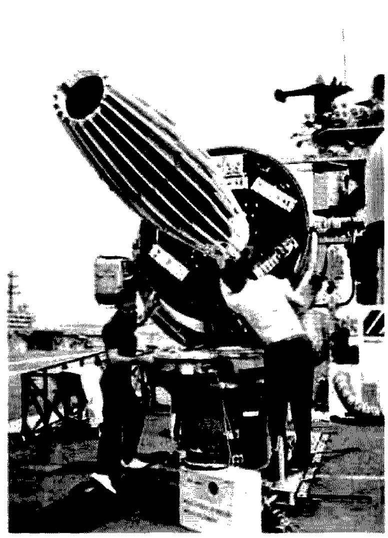
The object of this contest is to work as many CPR ZONES as possible. CW/RTTY dates 0001 GMT Feb. 17 to 2400 GMT Feb. 25; PHONE dates 0001 GMT Mar. 24 to 2400 GMT Apr. 1. Exchange signal report plus zone no. Final score equals no. of zones worked X no. of contacts. Contacts in own zone do not count as contact points. Mail all logs to L.M. Rundlett, 2001 Eye St., N.W., Wash., DC 20006.

GRANT COUNTY FESTIVITIES

February 18: Grant County Amateur Radio Club Swap and Shop at Jonesboro Park Shelter House, Jonesboro, Indiana – 10 AM to 4 PM.

LAKE COUNTY HAM BANQUET

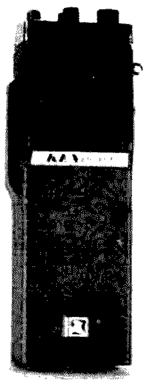
The Lake County (Indiana) Amateur Radio Club, Inc., proudly announces its 20th annual Radio Club Banquet to be held at the Scherwood Club, 600 East Joliet St., Schererville, Ind. The date is Saturday, February 10, 1973, and the affair starts promptly at 6:30 PM, CST. Awards, music, speeches, food – all you can eat – entertainment, good fellowship. Bring your wife, family, or girl friend. Tickets are $5 each, and are available from Herbert S. Brier, W9EGQ, 385 Johnson St., Gary, Indiana 46402, or from other club members. Positively no tickets sold at door.



Technicians prepare Western Union international's transportable satellite ground station, WUI-1, aboard the USS Ticonderoga to transmit live television coverage of the events surrounding Apollo 17 via communications satellite. The 15-foot diameter expandable parabolic antenna is mounted on a gyro-stabilized platform to enable an accurate view of the satellite regardless of the vessel's sea-going maneuvers.

NEW PRODUCTS

HAND TRANSCEIVER



If you were looking for a small 2-meter hand-held transceiver to hang onto your belt not too long ago, your search was probably limited . . . to what you could *find*. Now, with several types available you can afford to shop around a bit before making your decision.

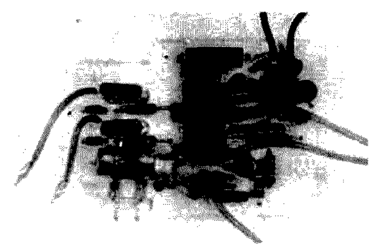
One to consider is the new KP-202, a six channel, 2 Watt unit that is being offered by Grove Electronics. Admittedly, 2W is a bit of a strain on a battery pack composed of 10–250 mAH ni-cads, but Grove works around the problem by using Fast-Charge cells that return to full charge in just 3 hours when connected to their accessory Super Charger. For such a small unit there is always a trade-off between battery life and power. The receiver has better than 0.35 μV sensitivity and draws about 15 mA on standby. One nice feature of the rig is that it has trimmer capacitors on not only the transmit but the receive crystals as well. These are an extra that is not found on some rigs that have space to spare.

Inside, the first thing you notice is the large amount of shielding that is used. Each section is surrounded by its own little wall of copper. The second thing you notice is, compared to other components, how much space is taken by the transistors. They seem huge next to the other subminiature parts. This is probably due to the super-tight packaging required to get all that circuitry into a hand sized case. The construction in general should stand plenty of hard use.

The controls include on/off volume, squelch and the channel switch. An output/voltage/S-meter is built-in and a telescoping whip is included, along with crystals for 34–94 and 94 simplex. The accessories include the nicad battery pack, their Super Charger, a leather case and a rubber-duckie whip.

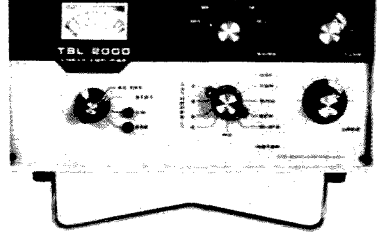
The price of the KP-202 less accessories is S219. Contact *Grove Electronics, Box 565, Roxbury Crossing MA 02120.*

SCANNER FOR HR-2



Topeka FM has just announced a two channel scanner for the Regency HR2 and HR2A transceiver. The unit plugs into HR-2 with only 3 soldering connections and one component change to the rig. Unit mounts internally above A, B, and C crystal sockets. Scanning is accomplished by inserting desired crystals into positions A and B on the board. A and B will be scanned when switch is in position C, thus no change to the radio is needed. Unique search-back feature allows unit to scan channel not in use every 5 seconds. This may be disabled or switched in and out. Scan rate is 20 times a second when no channel is in use. SCAN 2 is available for $19.95, including shipping, from *Topeka FM Communications and Electronics, 1313 E. 18th Terrace, Topeka KS 66607.*

ALL BAND LINEAR *(HONEST!)*



A new linear amplifier has been put on the amateur market by Top Band Systems that runs 2000 watts PEP on all *six* bands, 160 through 10 meters. For quite a while manufacturers of amateur equipment took great pride in advetising their all-band sideband rigs and linears. This was nice for them from an advertising proint of view. It gave the impression that the piece of gear they offered was all that was needed for full enjoyment of the HF frequencies. The problem was . . . they weren't exactly telling the truth . . . Lurking near the top end of the BC band, sandwiched in between skull rattling LORAN signals, was band number six. (Or band number ONE, depending on your particular feelings regarding the situation.)

If one wished to operate on 160, what equipment did he have to choose from? His *all-band* 80–10M rig did little to help the situation. Most amateurs had to scrounge around at hamfests for beat up gear that no one else wanted. A well equipped 160 station usually ran a Ranger I or a DX-100. This writer used a Lettine 240 for a long while before he advanced to a 20 year old converted Command Set. (Incidentally, a free 73 book is available to the first person who can send the Technical Editor a description of that old Lettine.)

Sideband was naturally a latecomer to the band. Not that SSB was unwelcome, there just wasn't any gear around. The only hope was to run into a stray 20-A at (again) a hamfest, or homebrew something. Heath offered a modified marine radio for a while, but it was restrictively crystal controlled. The situation was such that active 160 men were restricted from operating SSB because of the lack of equipment; and SSB men were restricted from operating 160 by their equipment's lack of flexibility. Lots of people were secretly angry at manufacturers.

Lately the picture has been changing . . . slowly. Since LORAN is on its way out as a navigation system, (it has been obsolete for a long time) people have started to take 160 seriously for what it always was, a damned good place in the spectrum to operate on. At least one manufacturer has taken the step to add that extra position on the bandswitch of his rig . . . and everyone is giving serious consideration towards doing the same.

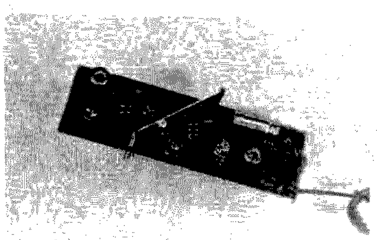
Suppose you are in the market for some new gear? Would you rather buy a five band or a six band rig? It makes little sense to spend that wad of cash and get cheated out of a band. And how about a linear? If you are thinking of getting one now, what are you going to do with it once you update your station with a six band exciter? Once LORAN goes, so does the power restrictions. Without that extra switch position you'll be destined to operate barefoot until you trade that amplifier in for something with more capabilities.

The TBL 2000 offers you a choice *now*. For an attractive price of $259 you can purchase a linear that will operate on all six bands whether you

are ready to or not. As opposed to being obsolete in the future, it is already one step ahead of the rest of your station! It uses five 6LF6 power pentodes in the final compartment which makes it easy when the time comes for replacement. A new set of finals can be ordered for $20. Each tube has its own bias control to make the job simple. The driving power required is between 70 and 150W and an ALC circuit protects the linear from doing what it is not supposed to. The metering system is practically absolute. There are switch positions to monitor the cathode current of each final tube separately, plus total plate, screen and grid currents and high voltage. As a bonus, a forward and reverse reading Wattmeter will measure outputs to 1000 Watts. The power supply is built-in and operates your 220V line. It is desktop and fairly lightweight – 10Kg (22 lbs). A modified version, the TBL 2000X, is available for the 110/220V operation. (15 Amps at the lower voltage.) It has all the same features but weights slightly more because of the extra transformer mass. 1805 kHz, watch out!

For further information contact: *Top Band Systems, 1839 Redondo Ave., Long Beach CA 90804.*

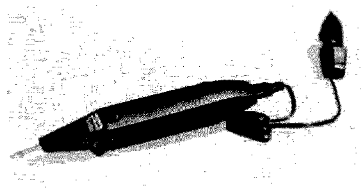
450 MHz PREAMP



One of the first things you start looking for once you have gotten over the excitement of completing your first 450 MHz QSO is something to pep up your receiver. Topeka FM has just added a dual-gate MOSFET preamp to their line that could possibly help quench that desire.

Constructed on a G11 low loss epoxy circuit board, the 450M has a voltage gain of 15 dB with a noise figure of typically 4.5 dB. The board is silver plated for maximum efficiency and has a shield on both sides for maximum isolation of the input and output circuits. The MOSFET design insures superior cross-modulation performance and reduced spurious responses. The input and output connectors are mated RCA and the unit comes complete with instructions and all mounting hardware. It is designed to operate from 10–15V but may be fed with higher plate voltages when the accessory HF450PK adaptor ($1.25) is used. Similar models for 406 to 470 MHz are available. $29.95 from *Topeka FM Communications and Electronics, 1313 E. 18th Terrace, Topeka KS 66607.*

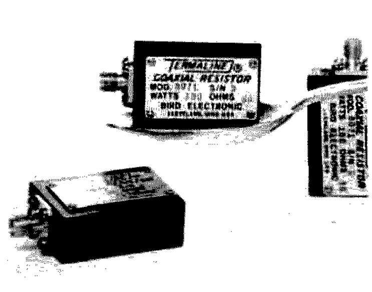
AUTO CHARGER FOR CORDLESS SOLDERING IRON



A new accessory is available for the Wahl "Iso-Tip" cordless soldering irons that lets you recharge their batteries via an automobile cigarette lighter. With this gadget, the serious mobile enthusiast no longer has *any* reason to leave his car. The last wire connection to the home QTH has been cut!

The increased portability is welcomed. Cordless soldering irons in themselves are great. What else are you going to use when soldering a connection at the top of a tower? Everything has been tried, from a torch to a match, but expectedly a soldering iron works best. The only trouble is when you get to that remote repeater site and you suddenly remember that the iron is still in the shack where you plugged it in the night before so it would get a good charge. For $4.95 you can get this adaptor that will let you keep that iron ready in the car (where it *belongs*, of course). An overnight charge will restore dead batteries to a full charge with negligible drain on the automobile system. The #7585 Auto Charger Plug Assembly is available from *Whal Clipper Corp., 2902 Locust St., Sterling IL 61081.*

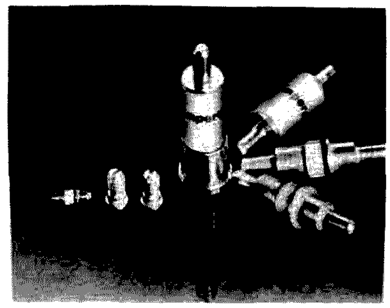
RF MINILOAD



A new 50Ω rf load resistor has been announced by Bird Electronic Corporation. As you can see from the photograph, it does not have the appearance you would expect of the average 100 watt dummy load. The tremendous reduction in size is accomplished by requiring the Miniload to be mounted to a suitable heatsink while in use. It is designed to allow maximum heat transfer from the resistive element to the case so almost any equipment panel or chassis will serve as the mounting point and heat sink. Just tuck it away in some unused corner and forget it. No need to hunt around for those (usually lost) interconnecting cables next time you want to do some work on your transmitter because the load will be built in.

The Model 8071 features a VSWR below 1.1 from dc to 1000 MHz and a figure below 1.2 up to 2000 MHz with its female SMA connector. The price is $125; from *Bird Electronic Corp., 30303 Aurora Road, Cleveland (Solon) OH 44139.*

MICROWAVE DIODES



Amperex Electronic Corporation has announced four new lines of microwave diodes for communications and other commercial applications. The four lines include 11 Schottky barrier devices, four tuning varactor diodes, 23 Gunn effect devices, and five IMPATT devices.

The 11 Schottky barrier diodes are intended for low-noise mixer and detector applications up to 18 GHz.

All 11 types in this group are available in matched pairs.

The four tuning varactor diodes are high-Q, GaAs, Schottky barrier devices. Each of these types offers a tuning range of 3:1 with voltage variation from 0 to 12 V and has low series resistance (max. 3.0Ω) for low circuit loss.

The 23 Gunn effect diodes offer a wide range of power outputs and frequencies for use in local oscillators in radar and communication systems.

The five silicon IMPATT devices are used as oscillators in telecommunications and radar systems at C, X and Ku band frequencies.

More information may be obtained by writing: *Product Manager, Amperex Electronic Corporation, Hicksville Division, Hicksville, New York 11802.*

DIGITAL PANEL METERS

A new line of digital panel meters are available from Weston Instruments. The series 1220 draws only 3/4W of power from a 6V source. They come in five voltage ranges from 0–100 mV to 0–1000V and five current ranges from 0–10μA to 0–100 mA. Accuracy is claimed to be ±0.1% of the displayed amount. Readout is accomplished by the use of plug-in LED display units and provision is made to incorporate a push-to-read circuit for battery conservation.

Although these meters are relatively expensive for ordinary ham use, just think of the fun you could have being the first one on the block to own a digital Wattmeter! The accuracy would be amazing. One of these meters could give you an unmatched record of your rig's performance by noting the slightest drop in power that would normally go unnoticed while watching a meter needle.

Prices for the Model 1220 digital meters run a bit under $100. For more information contact *D.F. DiCerto, Weston Instruments, 614 Frelinghuysen Ave. Newark NJ.*

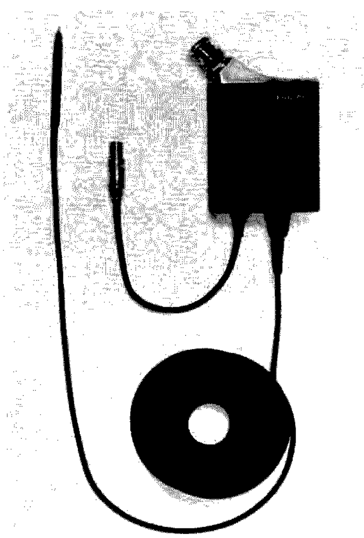
PORTABLE FIELD STRENGTH METER

Blonder-Tongue Laboratories has just announced the availability of a new, all solid state portable field strength meter.

Features normally associated only with laboratory or bench models include audio output jack (earphone provided), gold plated, accurately calibrated attenuator switches, and 75Ω type F connector for signal input. Meter is calibrated to read average signal strength and the entire unit operates on four standard 9V batteries with extremely low current consumption for extended life. Its range is from 54 to 890 MHz.

For further information contact *Blonder-Tongue Laboratories, Inc., One Jack Brown Road, Old Bridge, N.J.*

FET PROBE FOR OSCILLOSCOPE



A new active FET probe for wideband oscilloscope has been announced by Test & Measuring Instruments, Inc.

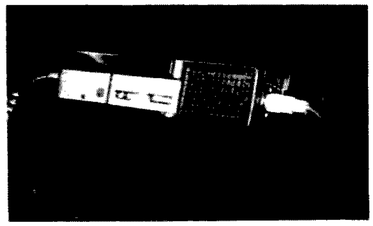
The PM9353 measures low amplitude, high frequency signals without appreciable circuit loading. The probe's bandwidth is 220 MHz, making it suitable for oscilloscopes with intrinsic bandwidths to [illegible] MHz with no adverse effect on the oscilloscope rise time.

Input impedance of the PM9353 is 3.5 pF in parallel with 1 MΩ; its unity-gain FET amplifier eliminates the 10:1 attenuation on conventional probes without introducing high input capacitance.

For detailed information write: *Test & Measuring Instruments Inc., 224 Duffy Avenue, Hicksville NY 11802.*

UHF "MOBILE COMMAND"

A two-way mobile radio that is slim, safety styled, has 5 watts of power output with all solid state circuitry and 3-channel capability on transmit and receive with recessed controls, plus optional tone squelch and selective call, the Model MC-405, is being marketed by The Hallicrafters Co.



The Model MC-405 operates in the 450–470 MHz frequency range, delivering 5 watts output. The radio's universal mounting tray permits it to be mounted horizontally or vertically, either on top of a flat surface or overhead, always leaving the controls readily accessible at a touch of the finger.

Tone squelch and selective call options further provide the user with truly personalized communications. The new "Mobile Command" UHF Model MC-405 is in the $600.00 price range. For further data, contact *The Hallicrafters Co., Dept. PR., 600 Hicks Road, Rolling Meadows IL 60008.*

W2NSD/1 continued

askance at articles showing how to build monitors to plug into that service function. Let's get those IC chips flying.

FAX

Hamfax looks like another fun way to go and 73 most eagerly solicits articles on every aspect of it. Let's see how to get machines on the air – where we can tune for fax signals – converter construction projects – the works.

MOVIE MONEY NEEDED

One of the more important events in recent history for amateur radio – and for emerging nations – has been the setting up of amateur radio stations in the schools in Jordan. Several of these have been set up and are being enthusiastically operated by a growing number of interested students.

As I have written before, the development of countries hinges today on their ability to communicate. Electronics and communications is the major key to their ability to develop. And without people who know and are interested in electronics a country is seriously hobbled. They need people to build equipment – to install it – to operate it – to service it.

Unfortunately, in virtually every smaller country, the emphasis is on

Continued on p. 156.

LETTERS

Reference certain letters appearing in 73, I suspect that you have now achieved the first genuine breakthrough in ham radio since SSB arrived. I refer to comments on the October and November covers. How much more rewarding than a picture of an IC, or some lad testing his antenna! I hope that most hams (and their XYL's) can take a mature view of the forest, as well as of the trees. Don't retreat.

Al Smith W1GAA/K3ZMS
Temple NH

I have *been* getting issues of 73, CQ, and QST for one year now. I have dumped my subscription to QST and will no longer purchase CQ at the newstand. They just can't cut it like 73 can. Keep up the good work, Wayne.

The November issue was fantastic. I got more out of it than all my QST's and CQ's put together. If the November issue is anything like what coming issues of 73 are going to be like, I will remain a faithful subscriber.

Dave WB5FWE
Fort Smith AR

After reading the letter on Page 62, Dec. 72 issue, from Mrs. Philip Shera, I could only wonder that if Mr. Shera was so puritanic, why did he not write that letter himself? Ho Ho Ho!

Frankly I love those adulterous thoughts I get after viewing your Oct. and especially Nov. 73 cover! I guess I'm just another dirty ole man ham!

You could send your 73's in a plain brown envelope if you have a second objection to the covers. You probably had only this one.

Clarence Jones
Saint George SC

My wife just saw the front cover of the November issue of 73. She says she don't care — but I can't subscribe to your magazine NO MORE!

Phil W0JHS

I am in total agreement with your November editorial re the new repeater rules. By imposing such unnecessary restrictive regulations on amateurs while at the same time permitting the bedlam that exists on 11 meters, the commission is fostering the same contempt for its authority that made CB what it is today.

I urge all readers to flood Washington with support for your petitions.

John Cable WA4AIZ
Raleigh NC

Wow! I wish to complement you fellers and gals for the best copy of a ham magazine I've ever read. If you keep this up, you are definitely No. 1. The articles on gravity and Tesla were classic. My XYL loved reading them also.

In the way of suggestion, I wish to recommend to you two new departments for classic papers: Entitle them the "Past Classic" (Tesla) and the "Future Classic" (Gravity). Then solicit articles for each department.

Best of luck and boy am I glad I have a life subscription.

Otto Grupp W9LH

The cover of your Nov. issue is stunning; the issue itself is outstanding. Keep up the cover and size of content. It's worth it at a buck and a half. Just great, just great!!!

Miles Cannon K4OLA
Athens GA

The November issue is terrific! Am making note in next "Old Timers Bulletin" about the Tesla article — telling readers to write to 73 if they wish to purchase a copy.

Bruce
The Antique Wireless Association, Inc.
Holcomb NY

Wayne, you didn't have to send me the renewal slip, I wouldn't miss an issue for a million bucks. I've tried all the major mags, and I find yours better than calling CQ or QST in Ham Radio (hi, hi).

I'm trying to get my ham friends to subscribe, and I've about got them, too!

Dave WN5GHN

C'mon, Wayne! How about a centerfold spread? You know — a stripped amplifier . . . a barefoot transmitter . . . a stacked antenna . . .

Michael R. Hanna K8UIJO
Parts Hts OH

Please correct the spelling of my last name. I've been called a lot of different names, but your interpretation takes the cake. The address label from 73 reads:

W F SWILL JR
3824 WICKER ST
HIGHLAND IN 46322

W. F. Swiss, Jr. W9HVY

P.S. Keep up the good design on the magazine covers, especially like the October issue.

Re: Gravity Abecedarium, Nov. 72, Par. 7

It seems to me that Kepler did a lot more than "obtain excellent observational data," so that "Newton was able to show that his principle of universal gravity did in fact explain beautifully the complex motions of the planet . . . "

According to the Encyclopedia Britannica, (ASTRONOMY), '54, Kepler's 3rd law, " . . . being a necessary *consequence* of the law of gravitation, must prevail in every system under its sway." Also, "The Rudolphine Tables computer by him (Kepler) from elliptic elements, retained authority for a century, and have in principle never been superseded." Furthermore, " . . . the importance of Kepler's generalizations was not fully appreciated until Sir Isaac Newton made them the cornerstone of his cosmic edifice." And finally, "The true foundations of a mechanical theory of the heavens were laid by Kepler's discoveries, and by Galileo's dynamical demonstrations . . . "

Newton's concept of gravity and his concept of point sources for gravitational forces both seem to have been implied in Kepler's laws. And Kepler was the first to " . . . explain beautifully the complex motions of the Planets . . . " 50 years ahead of Newton. K is for Kepler!

George W. Fyler W9JT
Lombard IL

Here is some update information for your Repeater Atlas:

Please delete the following —
Cherry Hill NJ Repeater (22/82)
Camden Repeater (22/82)
W2BHK Repeater (22/82)
W2FLY Repeater (22/82)
Plus whatever reference to a 22/82 repeater in South Jersey.

Now, where all this info came from is confusing — they are all one and the same machine.

Anyhow, a license has been received and we'd like to have it listed as follows:
WB2ZQG — South Jersey — 22/82 — open repeater.

For the record, it is a split-site repeater with an input at WB2EVU's QTH in Erial, N.J. (ground elevation 200 ft). Equipment is a 4-bay J pole on a 60 ft fower, GE Progress Line receiver and a Motorola T44 link transmitter.

The transmitter is located 3 miles away in Blenheim, N.J. at an abandoned commercial site (with permission of the owners, of course!)

Equipment is a T44 Rx and an RCA carphone. Transmitter at 40 watts to an Andrews 3dB antenna at 130 feet, fed with RG18. (Ground elevation ≈ 85 ft).

Control is accomplished with a second T44 receiver on 450 MHz using secode.

Coverage is approximately 30 miles from Exit 3 of N.J. Turnpike.

Continued on page 156.

FCC Report No. 8244, December 21, 1972
ACTION IN DOCKET CASE RULES FOR REPEATER STATIONS IN AMATEUR RADIO SERVICE AFFIRMED BY FCC

The amendments of Part 97 of the Amateur radio service rules adopted in the Commission's Report and Order in Docket 18803 (FCC 72-757, released September 8, 1972), have been affirmed by the FCC and numerous petitions for reconsideration, stay or changes have been denied. The Report and Order established rules for licensing and operation of repeater stations in the Amateur Radio Service.

(Repeater stations receive and automatically retransmit the radio signals of other amateur radio stations and are used primarily to extend the radiocommunication range of vehicular and hand-held mobile stations.)

The majority of petitioners objected to the rules requiring a control operator to be in attendance at a control point while a repeater station was in operation and to the placement of responsibility for proper operation of the station on the control operator. Seven petitioners requested that the burden for proper use of repeater stations be only on the user station operator transmitting on the input frequency of the repeater station and that the rules "limit the responsibility of a repeater station control operator to properly maintaining the technical operation of the station."

Several petitioners proposed a tone-access system in which the users would activate the repeater station by transmitting a certain combination of tones on the repeater station input communication frequency channel.

Stating that petitions added nothing to the information considered in adopting the Report and Order, the Commission explained that operation of a repeater station in the Amateur Radio Service could present unique problems not comparable to other radio service such as Land Mobile or Citizens Class A where control operators were not required at repeater stations.

In response to the tone-access system proposals, the Commission pointed out that a basic principal of radio control was that there be a reasonable probability the remote station would not be activated by unauthorized persons, and the control operator could indeed effect supervisory control of the station from the remote control point just as well as if the control point was located at the station.

Stating that the ingenuity of amateurs could eventually "develop the techniques, technical and operational," that would permit the adoption of rules for automatically controlled repeater stations and that it was conceivable that automatic and reliable means could be developed to perform "all of the supervisory functions of repeater station control operator under certain specific conditions," the Commission said provisions for automatic control were not warranted at this time.

Action by the Commission December 20, 1972, by Memorandum Opinion and Order. Commissioners Burch (Chairman), Robert E. Lee, H. Rex Lee, Reid, Wiley and Hooks with Commissioner Johnson concurring in the result.

Peter A. Stark K2OAW
196 Forest Drive
Mt. Kisco NY 10549

A TTL LOGIC CW ID GENERATOR

An ID generator is an important part of any 2-meter repeater, and several designs have appeared in various amateur magazines. There are various ways of doing the job, from code wheels and continuous tape loops to digital integrated circuits. We decided recently to design our own version, based on a digital IC identifier written up by W7PUG in *73* in September 1970.

This design improves on the original W7PUG design in several ways. It uses readily available TTL integrated circuits, instead of the older RTL circuitry. It is built on a single-sided printed circuit board rather than the double-sided one required for the older design. But most important, it uses a simple 32-position diode matrix for storing the call, and does not require the knowledge of Karnaugh maps or any other fancy techniques to decide where to put the diodes. And it is completely compatible with

The ID generator described in this article is part of a solid state repeater control system, the second half of which will be presented next month.

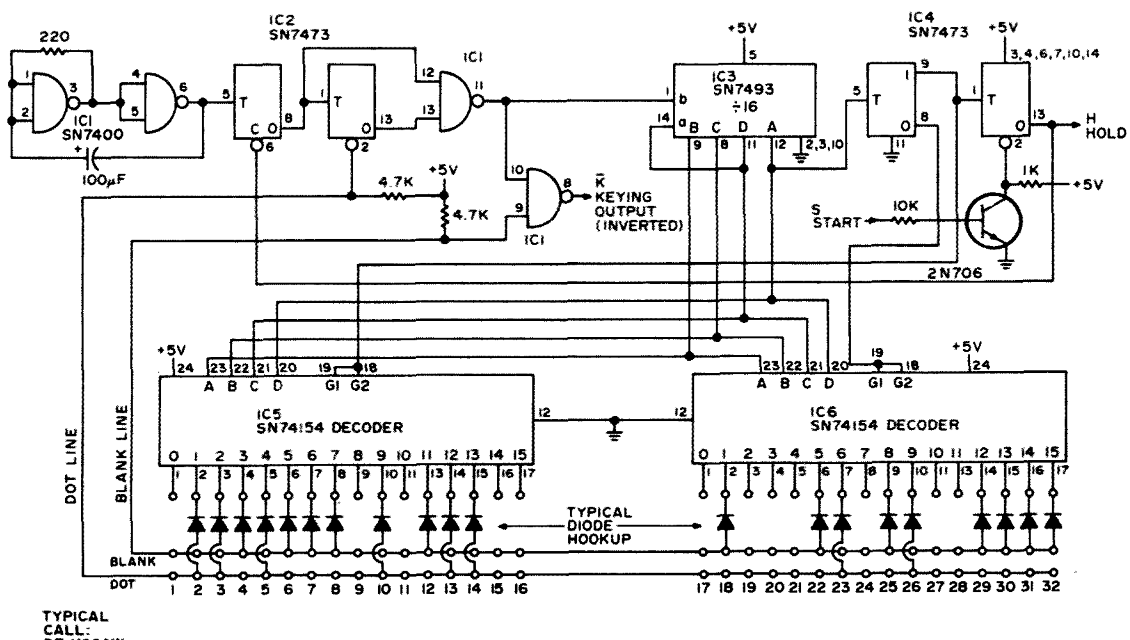


Fig. 1. CW identifier.

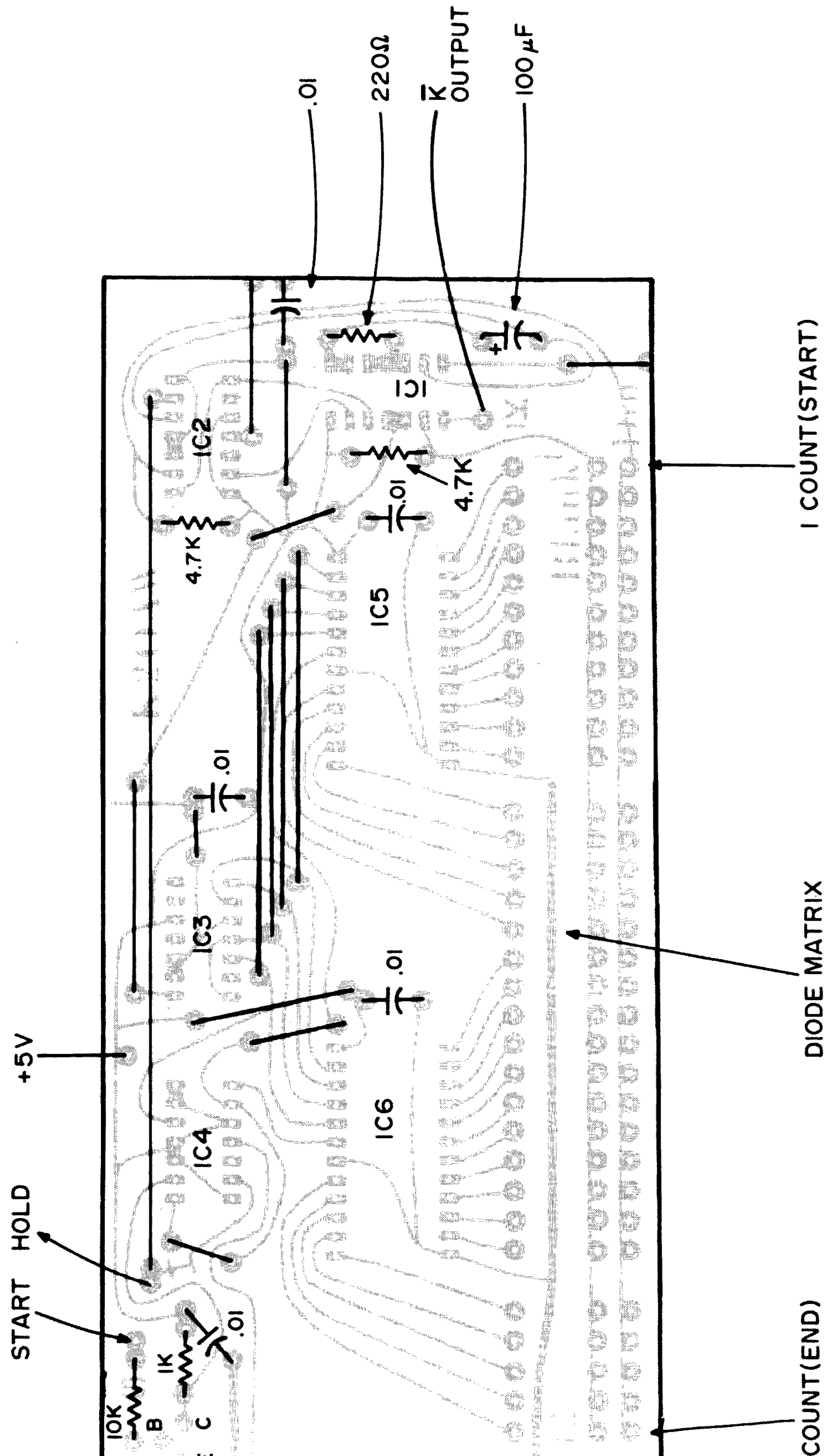
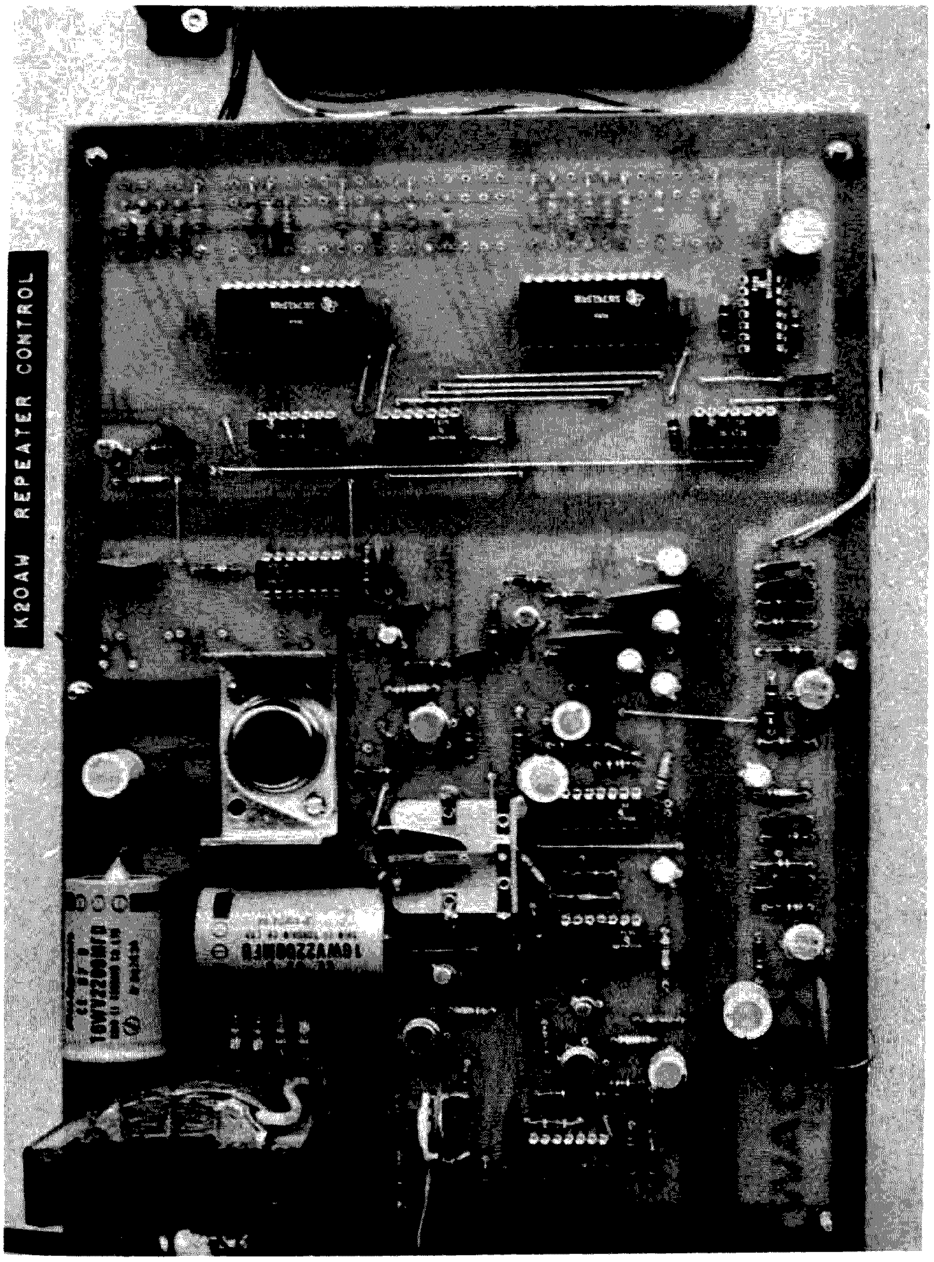


Fig. 2. I.D. parts layout board shown foil side up (full size). The edge of the board is at ground potential. Pin 1 of each IC is identified with a dot.

our all-solid-state repeater control, which will appear in an upcoming article.

Figure 1 shows the complete logic diagram of our unit. Two gates in IC1, in the upper left corner, oscillate and provide the clock for the system. IC2 is the character generator which controls the length of dots and dashes. A dot is exactly one clock interval, while a dash (or a blank) is exactly three clock intervals. After each dot, dash, or blank, a pulse is sent to IC3 which, along with a flip-flop in IC4, forms a divide-by-32 counter. The second flip-flop in IC4 is the start-stop flip-flop.

The output of the divide-by-32 counter is sent to two special purpose MSI IC's, IC5 and IC6. These are called four-line-to-sixteen-line decoders. Each of these two IC's gets the four outputs from IC3, and one output from IC4. The two IC's together provide a total of 32 output lines which are used to scan the diode matrix. In normal operation, 31 of these lines are high (near +5 volts) and only one is near ground. When the ID starts to generate the identification, the ground moves from pin to pin, starting with pin 1 of IC5 and moving down the line, finally winding up at pin 17 of IC6.



The upper third of the circuit board at the right contains the I.D. generator that is described in this article. The lower portion is the power supply and the repeater control circuitry that will be described next month.

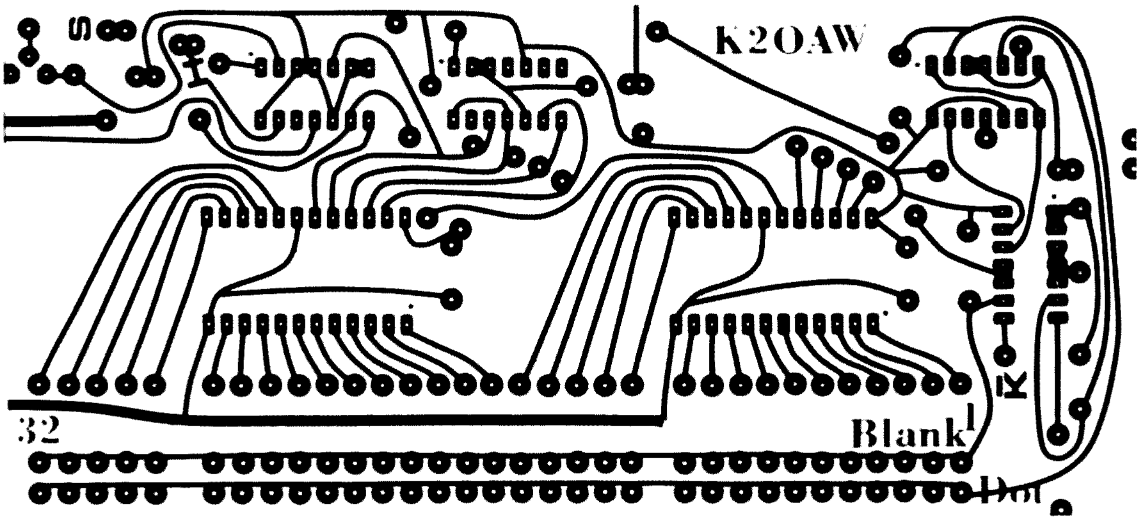


Fig. 3. Identifier board layout (80% actual size).

To program the diode matrix for a call, we separate the call into 32 dots, dashes, and letter-spaces (called blanks). With simple calls having K or W prefixes we generally have enough room to include a DE in front of the call; with a WA or WB call you will have to skip the DE. Then we number the dots, dashes, and blanks with numbers from 1 to 32, which assigns them to a specific position on the matrix. For every dot we place a diode from the corresponding IC output to the dot line; for every blank we connect the diode to the blank line; and for a dash we put in no diode. As shown in Fig. 1, the cathode side of the diode goes toward the decoder IC. You should use only germanium diodes here because we need a low voltage drop when the diode is on. Figure 1 shows the typical diode placement for generating DE K2OAW. Incidentally, if the call requires fewer than 32 positions, you will have to add blanks to stretch it out to 32 counts. It's better to add them at the beginning than the end, since this gives the transmitter time to come up before the code starts.

To use the ID you will need to make five external connections. The ID needs +5 volts regulated within 5%, at several hundred milliamperes and a good ground to the rest of your repeater control. To start the ID connect +5 volts (a digital 1 signal) to the start line (labeled S on the board). Output keying appears on the $\overline{K}$ line and is inverted – that is, this line is normally at +5 volts or so and switches down to ground when generating a dot or dash. The H output (hold) is normally grounded, and switches to +5 volts during the generation of the ID. Except for the $\overline{K}$ output, the other control signals operate the same as those in the W7PUG ID mentioned earlier. If you need complete compatibility, it is easy to add a transistor inverter to the $\overline{K}$ line to invert it back.

The entire ID generator fits on a single-sided PC board about 3 x 7 in. The board layout is shown in Fig. 3, and the parts placement is shown in Fig. 2. Speed of the ID is controlled by the 100 μF capacitor; the value shown generates code at about 5 wpm. To speed up the ID make the capacitor smaller. The five 0.01 μF capacitors are disk ceramics which bypass the +5V line to ground. Etched boards and parts kits are available from *Circuit Specialists, P.O. Box 3047, Scottsdale, Arizona 85257.*

In an upcoming article (soon!) we will present a complete solid-state repeater control, with ID timer, time-out timer, tone burst or PL latch, COR, and all the other necessities to make a complete package. The control fits on a 7 x 7 in. PC board. Alternatively, the control and ID can be built together as a complete package on one 7 x 10 in. board. . . .K2OAW

A. Prose Walker, Chief
Amateur and Citizens Division
Federal Communications Commission

THE EVOLUTION Of SPECTRUM MANAGEMENT

Mr. Walker made the following address at the 63rd Anniversary Banquet of The Radio Club of America, Inc., held in New York City on November 17, 1972:

Choosing a subject for tonight was not easy, I knew that the total expertise of all of you represents a great amount of knowledge and experience, accumulated over a long time. When one is called upon to speak before his peers, he is usually expected either to entertain or educate them. Those of you who know me, know that I'm not a comedian . . . at least intentionally. Although I have been involved in the allocation of the radio spectrum for more than 25 years, the aggregate of your experience so far outweighs mine that I seriously doubt I shall educate you. If I'm fortunate, many of you will have forgotten some of the details I shall recall to your mind.

"The technique utilized to get a clear channel (when diplomacy failed) was merely to lay a book on the telegraph key so that no one else could hear any other signals."

Evolution, by definition, involves change regardless of what is being considered. Change takes place at some rate, or velocity. Considering the time span from the birth of Christ, knowledge in the world did not double until 1750; the next doubling by 1900; the third by 1950 and the fourth by 1960. I'm not sure whether the fifth has yet occurred but probably so. If one consider man's existence to be 50,000 years, that would represent about 800 average life-spans. That many people could theoretically cover that period; about as many as could have attended this banquet tonight.

Of those 800 people 650 would have spent their lives in caves, or something worse;
Of those 800 people only the last 70 had any effective means of communicating with each other;
Of those 800 people, only the last six ever saw a printed word or could measure heat and cold;
Only the last four were able to measure time with any precision.
Almost everything that makes up our world was invented during the life span of the 800th person;
And more technological progress will be made during the life of the 801st person, than during the entire lifetimes of the previous 800.

Spectrum Management has existed ever since we learned to transmit information by means of electromagnetic waves. In understandable terms, it means reconciling in the best possible way the desired uses of the radio spectrum. Initially it was rather simple, as viewed from our vantage point of hindsight. But most things are that way. The usable radio spectrum has changed over the years from the first transmission across the Atlantic in 1901 on 328 kHz (915 meters), to the present complex of usable radio frequencies now extending up to 275,000 MHz, not including laser optical systems in use, and some other "electric" waves about which we know comparatively little. Consequently, the difficulty of the task of administering the spectrum has increased immensely since men began useing wireless waves.

Probably the very first attempt at spectrum management occurred because the extremely wide bandwidth of early spark transmitters would blanket *everything* on *any* frequency within a hundred miles or more of the transmitter. The technique utilized to get a clear channel (when diplomacy failed) was merely to lay a book on the telegraph key so that no one else could hear any other signals. But a succession of disasters at sea, culminating with the loss of the Titanic in April 1912, brought forcefully to mind that such a technique was not really useful as a spectrum management tool.

It was 1903 when Prince Heinrich of Prussia, enroute home from a visit to America, tried to send a courtesy message to President Theodore Roosevelt. He was refused service because the apparatus on board ship was of a different make than that of the shore station. That incident led to the first real attempt to manage the spectrum at the Berlin Conference of 1906, which was attended by representatives of 29 countries. The principal issues were, understandably,

obligatory communications regardless of the manufacturer of the equipment;
allocation of frequencies for public correspondence and maritime services,
and agreement on the use of "S O S" as the distress signal.

Their discussions must have been totally foreign to the modern concept of spectrum management which is judged by the criteria of bandwidth and signal-to-noise ratio required to transmit information at a given capacity in bits/second.

"When nations next met in Washington in 1927 . . . the frequency spectrum had been extended into the short waves above 3000 kHz primarily through the efforts of radio amateurs who had been denied the use of other frequencies."

By 1912 progress in wireless communication had progressed to 479 coast stations and 2752 ship stations of which 1964 were open to public correspondence. These developments lead to the next radio conference in London in 1912, where three new services came into being; *radio beacons, weather reports,* and *time signals,* with frequency bands allocated to each. Such was the state of affairs in wireless at the beginning of WW-I in 1914. When nations next met in Washington in 1927, three important scientific advances had been made in the field of radio;

broadcasting of radio programs had commenced;
radio sets had been installed in aircraft; and
the frequency spectrum had been extended into the short waves above 3000 kHz primarily through the efforts of radio amateurs who had been denied the use of other frequencies.

Many of you in this room remember the thrills of those days when you finally got a UV200 or 201, a 210 or a

203, to oscillate on roughly 200 or 80 meters, or if you were lucky, on 40 meters; building your own chemical rectifier and filter, and gazing in awe at the Roller Smith hot wire ammeter (Model No. HWA-1041), which was *absolutely necessary* to measure your "radiation."

By 1932, "broadcasting had expanded into the short waves, as had also commercial interests and government stations which had 'seen the light' uncovered by radio amateurs in their experiences."

Herbert Hoover was chairman of that 1927 conference, and a most revolutionary procedure was adopted to use the English language as well as French, the traditional language of diplomacy. However, all delegates were cautioned to "use the privilege with discretion!" This was the beginning of the establishment of the official languages of the ITU which now are English, French, and Spanish, with Russian and Chinese also included as working languages. In cases of dispute, the French text is still considered the official version. The work of the 1927 conference was so exhausting (it had nearly 2000 proposals before it) that it took what has proven to be a most important step in establishing a Consultative Committee which has withstood the test of time and is now known as the C.C.I.R. (from the French version of the title).

The usable frequency spectrum as then understood extended from 10 kHz to 60,000 kHz and the real difficulties of spectrum management had begun. After a table of frequency allocation was drawn up,

how should the rights of conflicting parties be settled? . . .

. . . if a station changed frequency or a new station started up which caused interference, which station had priority?

After lengthy discussions it was concluded that there was no possible way in practice to make adherence to the table of allocations obligatory. That principle is still true today as evidenced by the numerous reservations taken by many countries in the present International Radio Regulations, and the many transmissions which do not coincide with the Table of Allocations.

The period from 1932 up to the beginning of WW-II, encompassed two international conferences at Madrid and Cairo where additional scientific developments were taken into account.

1) broadcasting had expanded into the short waves, as had also commercial interests and government stations which had "seen the light" uncovered by radio amateurs in their experiences;

2) by 1934 there was a kind of radar in existence, and

3) in 1936 the BBC in London was broadcasting a "high definition" television service using 180 lines, which had been received on this side of the Atlantic.

During these early days after broadcasting became established, the portion of the spectrum which gave most difficulty to allocation people was from 150—1500 kHz. Little did they know what was to be the future of medium frequencies, later known as the standard broadcast band. As stations became more numerous, ways were sought to enable them to operate without causing undue mutual interference. One of the applicable techniques developed was the directional antenna, using vertical radiating elements with spacing, phrasing and current ratios adjusted to produce the desired radiation fields in the wanted directions. The beginning of an era of consulting engineering was introduced by the installation in 1940 of such an antenna at WFLA in Tampa, Florida by the late FCC Commissioner T. A. M. Craven and Raymond Wilmotte. Since that time, the allocation, or assignment, of stations in the standard broadcast band has been on an engineering basis, with complicated directional arrays now in use by roughly 2500 AM broadcasting stations in this country.

Almost as soon as we realized that frequency congestion would become a future problem, we found the world engaged in another World War. In all countries involved in the scene of the struggle, terrible destruction of telecommunication facilities took place. Suffice to say that in France alone:

54,000 miles of overhead wires were down;
60 relay stations were destroyed;
30 cities had their underground cables cut;
110 telegraph offices lay in ruins;
50 submarine cables had been severed;
and of the original 42 French national broadcasting transmitters, only four were usable at the end of the war.

Wars are waste, however much they accelerate technological progress. During WW-II more technical developments were made than in the entire previous history of telecommunication . . . which laid the base for everything that has occurred in spectrum management since that time.

Following the war, the Big Five powers met in Moscow to discuss preparation for the next international telecommunication conference which had been recognized as absolutely essential to avoid utter chaos in peaceful applications of war-time developments. Only the United States was relatively unscathed by the war; and characteristically, we desired to use this advantage for the benefit of others. This led to the World Administrative Radio Conference, the Plenipotentiary Conference, and the first of a series of High Frequency Broadcast Conferences in 1947 at Atlantic City. Six hundred delegates from 76 countries attended to the post-war problems of the spectrum, not entirely aware of the tremendous added burdens to come into the scene with post-war developments and applications in the regions of VHF, UHF and SHF. Television was still an experiment on VHF, but wartime radar techniques brought it into clear focus shortly after the end of hostilities. Fortunately for the United States, our government had recognized the impending spectrum utilization, and as early as 1944—45 before the war had ended, called General Allocation hearings on uses of the spectrum. This set the stage for the United States position at the Atlantic City WARC.

"During WW-II more technical developments were made than in the entire previous history of telecommunication . . . "

The significant problem of the post-war years, which still has not been solved, relates to international standards for television. At Atlantic City in 1947, delegates were unworried about the allocation of the spectrum from about 30 MHz to 10.5 GHz. They concluded that it could be allocated to radar, television, FM broadcasting and a few other "relatively minor services." What can happen even with considerable international liaison in our present world of telecommunication is typified by present television standards in use throughout the world. In the United Kingdom they use 405 lines on VHF, but on UHF they use the CCIR standard of 625 lines. In the United States we established our system using 525 lines, and the French use 819 lines. This perhaps wasn't so bad, although annoying, until along came color television. No other subject ever elicited such acrimonious debate among I.T.U. delegates as the subject of color television standards at meetings in Vienna in 1965 and Oslo in

1966. We had the NTSC simultaneous color system; the French had their SECAM systems; Germany introduced the PAL system and Austria came up with what was called QUAM.

Some witty delegate coined some humorous descriptions for these systems which you might enjoy:

NTSC – Never Twice the Same Color

SECAM – System Elegante Contre L'Allemagne

PAL – Pay for Additional Luxury

QUAM – Quick Austrian Modification

So we not only have four different line standards but also different systems for encoding and transmitting color pictures. Fortunately the four mentioned (actually there were more) have been pared down to three. Every time you see a satellite picture coming from the European area, remember it had to start out with a different line scanning standard as well as a different color encoding system, and go through a standards converter in order for it to be seen on your color television set. I often marvel at the preservation of quality considering everything that has to be done. We have learned that spectrum management becomes dependent on technical standards. As you look at the various TV systems in use throughout the world we find great variations in such important parameters as channel width, spacing between sound and video carriers, width and attenuation of the vestigial sideband, type and polarity of modulation, ad infinitum. I mention these aspects only as examples of factors taken into account in considering how to use the spectrum. Other examples could practically fill a book, and still relate to only technical aspects.

"By 1980 it has been predicted that the Amateur population of the world will be between six and eight hundred thousand."

Probably I should have stated initially that any attempt to comprehensively cover this subject would require much longer than you would like to listen. At this point we have progressed beyond WW-II and the technological revolution has just begun. You realize, I know, that any agency of the government which uses frequencies (and most of them do) has a group of spectrum managers overseeing their requirements. No agency can act alone in this field because of the interaction among the various uses of the spectrum. So there is a group of government spectrum managers called the Interdepartment Radio Advisory Committee (IRAC), which has existed since 1922 by various names. The broad main charter of this group is to take care of the frequency requirements of each agency of the government. The FCC is a liaison member, because its responsibility is to the civilian uses of radio, and therefore close coordination is required.

The IRAC has a membership of 16 departments or agencies, and three permanent subcommittees; Frequency Assignment, Spectrum Planning and Technical. The IRAC and its subcommittees are chaired by officials of the Office of Telecommunications Policy, whose Director is Dr. Clay T. Whitehead. The magnitude of the government's use of the spectrum almost staggers one's imagination. The dollar investment is over $50 billion; millions of transmitters are operating daily; government frequency assignments amount to about 120,000 and the number of governmental missions depending on radio is incalculable. No wonder such a group is required to exercise the President's responsibility in this area of spectrum management.

Although there are thousands of worthy post-war developments, I would choose the satellite as the one which will remain the oustanding example of technology covering a wide variety of fields. Satellite communication became a reality on July 10, 1962, a short ten years ago. TELSTAR I was designed and built by Bell Laboratories and launched by NASA in just 18 months. Its impact is still being felt throughout the world. Congress created the Communications Satellite Corporation three months after TELSTAR, and the international consortium known as INTELSAT now numbers 82 nations as members.

The evolution of international communications has proceeded rapidly through increased utilization of both cables and satellites. The INTELSAT system, now in fourth generation satellites, has increased its technological capacity from 240 voice circuits for INTELSAT I to 9000 such circuits in INTELSAT IV in the spot-beam mode, or 12 TV channels, or various combinations depending on modes, emissions and radiation configurations. In 1965 we had only two point coverage over the Atlantic basin in the northern hemisphere, whereas today several satellites provide practically total coverage in the Atlantic, Pacific and Indian Ocean basins with more than 80 antennas at 64 earth stations in 49 countries. Technological investigations now under way indicate that whenever traffic volume justifies it, a new generation of satellites can be provided during the late 1970's capable of providing 20,000 to 30,000 voice circuits with a maximum degree of redundancy to achieve the highest standards of reliability and useful lifetime. Although evolution of cable capcity is not so dramatic as that of satellites, it has increased from 36 voice channels in the first cable authorized, to current and planned capcities of three thousand such channels or even higher, per cable. We now have cable connections from the United States to Europe via TAT-1 through 5, to Bermuda, Puerto Rico, Virgin Islands, Jamaica, Panama, Cuba, Hawaii, Japan, Hong Kong, Phillippines and southeast Asia on to Australia.

"Frequencies allocated to Amateurs have been gradually whittled away over the years, rather than increased . . . they will desperately need additional spectrum space in the 3–30 MHz area."

Every service concerned with long distance and international communication has felt the impact of these achievements. Work in the CCIR, recent ITU conferences, and proceedings before the FCC emphasize that communications handled by the Fixed, Aeronautical and Maritime Services are either in process of transition now or are being planned for satellites in the near future. What happens to the HF spectrum which is currently allocated to these services? Well, obviously it will not mean a complete reduction of their HF spectrum allocation, because there will be a number of countries throughout the world without cable terminals and satellite earth stations. Such a major evolutionary development in communications makes it obvious that we must reexamine the utilization of the high frequency spectrum. The last over-all allocation from 3–30 MHz was in 1959 before we had a satellite system and prior to current cable expansion. Undoubtedly, new services and several old ones will clamor for more spectrum space.

The High Frequency Broadcast Service now assigns stations every 5 kHz, utilizing geographic sharing, time sharing, highly directional antennas, and restriction of maximum modulating frequencies to 6400 Hz. They will want more bands; something like ten, probably 500 kHz wide. By 1980 it has been predicted that the Amateur population of the world will be between six and eight hundred thousand. Frequencies allocated to Amateurs have been gradually whittled away over the years, rather than increased, as with most other

services; and if the prediction of their numbers should come even close to being true, they will desperately need additional spectrum space in the 3–30 MHz area. Large areas of the spectrum must not be pre-empted by stations moving into unoccupied regions of the spectrum in a haphazard manner. (Some of this is currently taking place). That will only make the future administration of the spectrum more difficult. In my opinion, a study of the re-allocation of the HF spectrum will be inevitable. Services which have major blocks of HF spectrum allocated to them and which are going to cables and satellites with their traffic, will receive close scrutiny by the world's spectrum managers.

What does this mean to spectrum management? Well, in 1971 it meant a World Administrative Radio Conference specifcally dealing with Space Telecommunication. Allocators now must think in new terms which ten years ago would have been foreign to their vocabulary except in specialized areas of communication. They now must deal with

progagation effects on earth-space transmissions instead of just the usual phenomena of F_2 layer transmission, ducting, sporadic E, etc.;
the atmosphere "window" through which signals pass without undue absorption;
Signal levels in terms of dBW/m^2 of power flux density instead of signal strength in $\mu v/m$;
angle of elevation;
refraction phenomena;
scintillation and scatter;
Dopper and Faraday effects;
station keeping of the satellite;
interference from the sun, and
echoes, noise temperature of the receiving system, and a host of others too numerous to list.

All problems of spectrum utilization are certainly not solved because we have a satellite system. The tremendous requirements for mobile communications by the countless users in the various Land-Mobile Services have led to extreme pressures on desirable regions of the VHF and UHF spectrum. Although frequency sharing has existed for years, our parochial system of frequency allocation has been by the block method. Within each allocated block, station assignments in particular services are made. But Land-Mobile needs more spectrum, which has been the subject of numerous papers, hearings, discussions, arguments and controversies over the past several years. Land-Mobile stations are now sharing certain of the UHF television channels under specified conditions. Still the growth continues and the squeeze on the spectrum has resulted in an attempt to bring modern technology into the Land-Mobile frequency management process.

"Perhaps certain of these unseen radiations will be discovered to be the catalyst which will enable people to communicate reliably by thought transmission."

No doubt many of you know about the spectrum management project which the Commission is now implementing in Chicago. This probram will require building and maintenace of a complete administratige and technical data base containing the records of all the licenses within a particular area. That data will be used as the FCC's automated record of the licenses, and will provide the engineering environment to enable making more optimum frequency assignments. The data bank will contain not only data from the Application Form 425, but also inputs from monitoring observations. There are differences of opinion as to whether sufficient benefits can be derived from such an endeavor to make the result positive in terms of cost-effectiveness. It requires considerable money to conduct such an operation. No one can predict yet with much reliability just how much more spectrum utilization can be obtained by these methods, nor at what cost per application or channel assignment. Only time will tell. For administrative purposes, plans and budgets are being prepared for extending the project into the other areas of the country. Regardless of which side of the fence one may be inclined respecting this project, it is an attempt to utilize modern techniques involving magnetically stored data and a computer to improve the use which can be obtained from one area of the radio spectrum. It is a step in the right direction toward making a more effective value judgment of spectrum management. Its evaluation is awaited with interest.

There are always competing claims on the spectrum. There are five usually applied criteria in determining priority of use:

1. Inability to use wirelines or other substitutes for radio;
2. Contribution to maintaining safety of life and property;
3. The number of people who would benefit;
4. The demands of the public for the output of the service, and
5. The technical suitability of the spectrum requrested for the requirements of the service.

When all is said and done, and we have every transmitter on the right frequency operating in the best interests of its users, we have a lot of electromagnetic energy wafting around throughout the area here on earth where people live. You can't see it, but do you wonder if there are any effects on humans from all this electromagnetic energy to which we are all subjected? Is there any relationship between the known forms of radiation and those "waves" about which we know so little? There are some measurable side-effects of electromagnetic radiations:

At 700 Hz we can produce electrical anesthesia;
Certain components of living cells in people are resonant in the aural and television broadcasting bands;
We know that ants will align their antennae parallel to an electromagnetic field at 9 MHz;
Radiation at 21 MHz increases the germination of gladiolus bulbs by 200%;
Emissions at 27 MHz affect growing cells of garlic plants;
You can kill bugs in bread with emissions at 29 MHz;
Short exposure to energy in the 300–3000 MHz region expedites regrowth of severed nerve cells, and
Radiations at 388 MHz are lethal to monkeys.

If one had the acumen to evaluate the present with the hindsight of the 802nd or 803rd person, I'm certain we would conclude that the science of communication is still in its infancy, despite the wondrous things that have come about. Perhaps certain of these unseen radiations will be discovered to be the catalyst which will enable people to communicate reliably by *thought transmission.* We know that some people have such limited powers now, although we don't understand yet the details of how it is done. There is much research in progress on the subject throughout the world.

After thousands of years of development in mechanical technology, we are now engaged in extending our thought transference by electromagnetic means throughout our globe. We are even probing outer space, for some sign of life and intelligence there with which to communicate. If we do this, the final phase of the extension of mankind may well be, as Marshall McLuhan puts it,

"... simulation of consciousness, when the creative process of knowing will be collectively and corporately extended to the whole of human society, much as we have already extended our senses and nerves by the various media ..."

When that time arrives, God help the spectrum managers!

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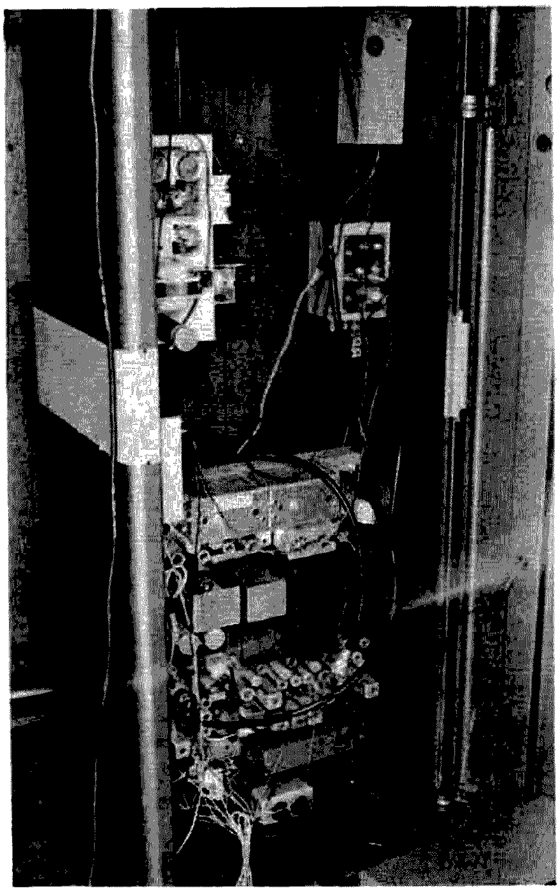

PHASE LOCKED LOOP DECODER

A continuous tone operated relay for the repeater or remote

A continuous tone squelch or relay is used in a repeater or remote base system where it is desirable to restrict use of the machine to only certain individuals, or to select one repeater if there is more than one system sharing the same channels. Commercial names for this system include Private Line, Quiet Channel, and Channel Guard. This is accomplished by transmitting a low frequency, low deviation, continuous tone along with the carrier and other modulation of the accessing transmitter. Only transmitters with the proper tone will activate the tone operated relay in the repeater.

Single tone or "beep tone" is also used for this purpose, and this decoder can also be used as a single tone decoder. However, single tone is an inferior system since it creates an annoying audible tone. Also it defeats the purpose of tone access when an undesirable carrier can hold the repeater on, and anyone can access it by simply whistling.

The continuous tone system is usually inaudible, and cannot be activated by a whistle.

The System

This article describes a continuous tone squelch decoder–encoder system that is completely solid state with no expensive, unreliable mechanical reeds. The decoder is relatively easy to build, featuring a Signetics phase locked loop decoder integrated circuit. The decoder can operate consistently with a tone that is as much as 6 dB below the wideband noise level. The detection frequency and bandwidth are adjustable by external component selection. In this case

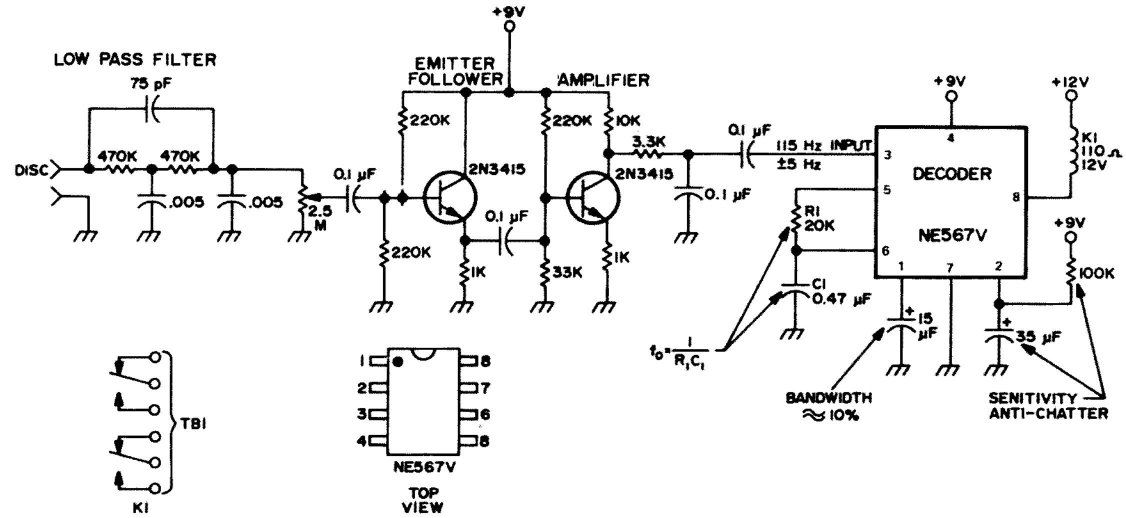

Fig. 1. Decoder schematic.

the bandwidth was set relatively wide to allow for frequency instability on the encoder. This allows the simplest possible encoder circuit to be used. This is a good consideration in a large group of repeater users where some members may not have the desire to buy or build an expensive, complicated encoder. The encoder uses a simple phase shift oscillator circuit.

The Circuit

Figure 1 shows the schematic of the decoder. The signal must be taken directly from the discriminator of the receiver. The low pass filter removes most of the higher frequency signal components that may be at a higher level than the tone signal. The filter prevents strong out of band signals from desensitizing the decoder. The emitter follower provides a high impedance input to minimize loading effects on the discriminator. An amplifier is necessary to bring the signal up to the proper level for the decoder.

Although the decoder has more than fifty transistors in its integrated circuit, only a few external components are necessary to set the desired operating conditions. The detection frequency is: fo = 1/R1C1. From the values shown in Fig. 1: fo = 1/(20 x 10^3)(.47 x 10^{-6}) = 107 Hz. In actual on the air tests with an audio oscillator and frequency counter, a center frequency of 110 Hz was measured. R1 and C1 can be varied to select the desired frequency, but R1 should be kept between 2000 and 20,000Ω for best stability. The 15μF capacitor affects the bandwidth, which was set at about 10%. Tests again show a frequency response from 105–115 Hz. A smaller value capacitor would narrow the bandwidth. The 35 μF capacitor and the 100 K resistor circuit affect bandwidth, sensitivity, and help prevent chatter. Information on this was obtained from Signetics application notes, and final values were obtained experimentally.

The output of the decoder can sink up to 100 mA, so it is used to drive a relay directly. Nine volts is used to power the decoder and preceeding transistors, but 12 volts is used as a voltage source for the relay. The output of the decoder on pin 8 of the integrated circuit can operate to as high a voltage as 15 volts without damage, but the rest of the IC must be held to less than 10 volts.

The circuit of the encoder is shown in Fig. 2. The circuit shows a phase shift

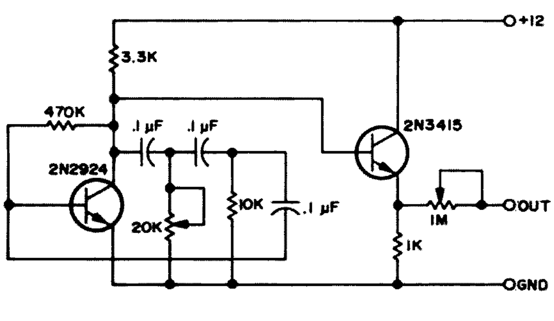

Fig. 2. Encoder schematic.

oscillator followed by an emitter follower. The 20K variable resistor sets the desired frequency of oscillation.

Construction

Since such low frequencies were involved, parts layout was not critical. The decoder was built on a piece of Vectorboard and mounted inside a small LMB chassis box. The integrated circuit and application notes were obtained from Solid State Systems, Inc. Capacitors smaller than 0.1 μF can be disc ceramic, but capacitors in frequency determining circuits should be of as high a quality as possible. Mylar capacitors were used in this case. The capacitors marked with polarity were electrolytic.

If the encoder oscillator is put near a strong rf field it may not oscillate. This can be cured by bypassing the power leads with a .01 μF capacitor, or shielding the entire circuit if necessary.

2N3415's were used for the two transistors in the decoder and for the emitter follower in the encoder. A 2N2924 was used in the oscillator circuit.

Operation

The input of the filter circuit in the decoder unit is connected to the discriminator of the receiver. This circuit has been used with RCA CMU15 and Motorola T44 receivers, and should work as well with other similar receivers that have enough discriminator signal.

The encoder in the transmitter should be connected as directly as possible to the phase modulator. It is usually connected to the deviation control.

To adjust the levels, the tone deviation of the transmitter should be set to 500 Hz, and the *combined* tone and voice deviation should be set to a maximum of 5 kHz. Triple these numbers for a 450 wideband system, remembering to keep the combined deviation below maximum limits, since the tone and voice signals add on peaks.

With the transmitter deviation set properly, and a combined voice and tone signal coming from the receiver, increase the level control until the relay holds in without dropping out on voice peaks. If the level is advanced too far, the decoder may give false outputs from the filtered noise sent to it. Setting levels may take considerable trial and error if proper test equipment is not available. In any case, the objective is to set the transmitter tone deviation as low as possible without having voice peaks false the decoder off, and to have the decoder as sensitive as possible without giving false outputs on noise.

After the system is operating, it should be impossible to hear the tone in a receiver listening to the repeater. If a buzzing sound is detected on a signal, it is usually the result of distortion in the transmitter audio, causing audible harmonics. If the tone is applied to the microphone jack of the transmitter, the tone will probably be audible since the tone level must be increased in proportion to the voice signals. This is because the frequency response of most transmitters is limited below 300 Hz. Also, if the tone signal received at the decoder is very distorted, the level may have to be increased to hold in the relay.

At different times the relay may pull in almost instantly or may take as long as a few tenths of a second to activate. This depends upon the phase relationship between the signal from the encoder and the signal of the internal oscillator in the decoder integrated circuit. This effect is unpredictable.

The decoder should make a good single tone decoder also. This might be done by eliminating the low pass filter from the input, and changing R1 and C1 to different values for the desired frequency. The two electrolytic capacitors should be changed from 15 and 35 μF to 2 and 5 μF respectively. It would be necessary to provide output latching for the circuit, and unlatching by the COR.

Conclusion

This project only took a few days to make operational, and has been operating reliably for about four months now. The integrated circuit was the most expensive item, and it only cost a few dollars. Integrated circuit prices have been getting lower every month. Construction of the encoder is a simple task, and would make an ideal club project. When compared to the price of a tone reed that may have to be replaced in a few years, the solid state system is a real bargain to protect the input of your system.

. . .WB6BIH

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TOROIDAL QUADRATURE ANTENNA

My work on the "Long Circular Quad," was a needed departure into endfire antenna design which proved ring shaped elements to be superior to discrete directors in – the possibly obsolete – Yagi configuration. Extensive tests on a professional antenna range proved that.

Another, although unproved departure from the norm, was George A. H. Bonadio's *Square / Diagonal Antenna*, commonly thought to be a diversity antenna, when in reality it is quite similar to an '8JK multi-driven element collinear/broadside array.

While these two antennas have nothing in similarity except their novelty, however, it might interest the reader to know that W4KAE spent many hours contemplating just the same arrangement that Mr. Bonadio thought up, except he couldn't stand the idea of using tuned lines – so the project was abandoned. I guess what I had in mind was a point-source with gain. Anyway, after reading W2WLR's article, I knew the principle of operation: Simply use 90 degree physical and electrical phasing on each pair of 4 or 8 wires; place them in the correct plane for the desired radiation; and even semivertical "diversity operation," can be obtained. True diversity would require more than one set of antennas – not simply relays!

These random thoughts and conclusions led W4KAE to test the "Quadrature Approach" in practical form, without tuned lines or relays. Being familiar with the quadrature phasing (90°) concept for winding low-power octave bandwidth receiving networks, I immediately began to wind the coils for the "Toroidal Quadrature Antenna."

TQA Theory

Reiterating the phasing concept above: The Square/Diagonal Antenna is basically no more than a set of four wires, arranged in phase quadrature. This means there is ninety electrical degrees between each leg, and preferably 90° physical/angular "spacing" between each wire. The length of the elements can be made from either one or two *electrical* wavelengths, the choice depending mostly upon space and gain desired. Optimum design standpoint would utilize a minimum physical wavelength of about 3/8 wavelengths-per-leg. This is doubled to be 3/4 wavelength because of criss-crossed quadrature connections to the transforming coils – and the whole element functions as a full electrical wavelength – with the additional "length" contained in the coils. Obviously whenever a particular design is op-

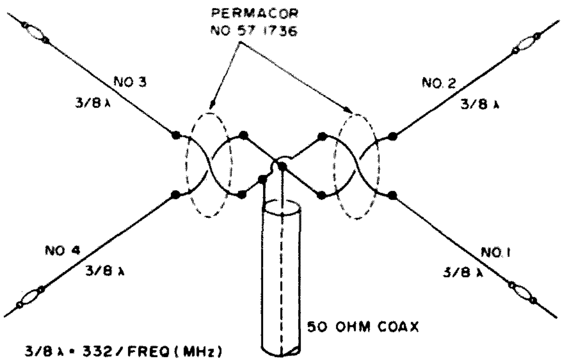

Fig. 1. TQA connections. The constant – 332 – includes shortening factors and quad-coil loading.

timized by cut-and-try coil wind and substitution, lowest swr readings are the criterion of proper operation, along with proper continuity tests.

Derivation of element formulas is quite simple – if you don't overlook the ninety degrees in the network! Keep in mind also that since each complementary two-wire element functions as one full wavelength, you must double the usual shortening factor. There is also 2 or 3 per cent compensation present using 10% instead of 5%. We won't go into that, however.

Figure 1 shows the quadrature networks in use by W4KAE. Briefly, to calculate an element length (equal to two "legs") we take 984 minus 246, which leaves a new constant of 738. From this figure, ten per cent is to be taken off, or about 74 from 738, which leaves 664. $664/F_{MHz}$, is for 3/4 physical wavelength. Half of this is $332F_{MHz}$, for each 3/8 wavelength leg. This arithmetic is for the optimum or small-space model. If you want two to four decibels (estimated) additional gain, use the following method:

Take twice 984, or 1968. Take twice 74 or 148 off, for double the 10% shortening factor. Next, take off twice 246 from the number 1968, which leaves 1476. From 1476 subtract the shortening factor (148) found above. This leaves the figure 1328 or $1328/F_{MHz}$ which is for two legs. Half of this becomes $664/F_{MHz}$ which is exactly double the 3/8 wavelength previously. It is also a good check. I have no information about swr in this design.

The TQA connections are made in Fig. 1. Observe that there is dc continuity between elements No. 1,3 and No. 2,4. Similarity to the W2WLR design can be seen where the classical 90 degree phasing, from element to element, is obvious. Dashed-line ellipses are representative of the powdered iron Carbonyl SF cores.

Gain obtained from the TQA should be about the same as from W8JK's two-section flat-top, which appears on page 151 of *The ARRL Antenna Book*, ninth edition, 1960. The spacing between each bay of endfire elements is conveniently eliminated in our version of the Toroidal Quadrature Antenna. Noting the continuity between complementary legs, it is only a short step to place each wire at physical right angles with the other, for overall correct phasor relationships. String the whole array into the same vertical or horizontal plane and you've got an improved quadrature design. With two arrays, in opposing planes, then you have true diversity, not just semi-vertical polarization! Here, a relay and switching networks would be feasible.

Although I do not have facilities to accurately check actual gain readings against a dipole, it should be adequate to figure, by rule of thumb, that 6 dBD is available for the "optimum" design; or 8 dBD for the longer model. Maybe you could expect 10 dBD by combining both collinear and broad-

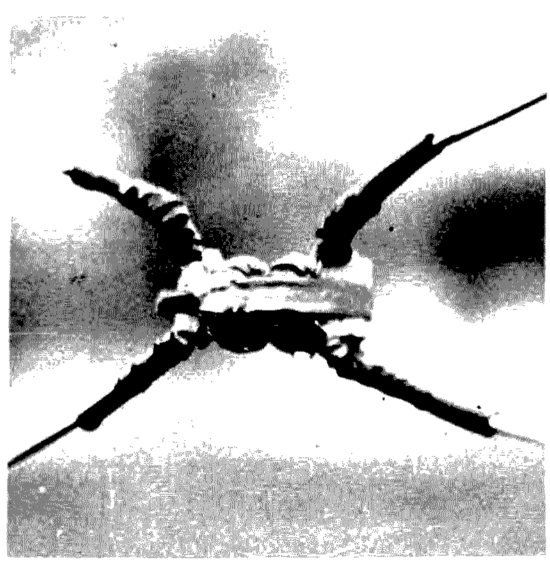

Fig. 2. TQA receiving coils. With wire of proper size and leg length of about 15 ft, reception for SWL and WWV monitoring is satisfactory. Frequency coverage from an octave below the normalized frequency to an octave above, is feasible.

Fig. 3. This shows the quadrature coils before encapsulation. Two No. 57-1736 Permacor cores are wound with No. 16 Beldsol wire, in a bifilar fashion. This pair is for 6 meter sample, sent to Wayne Green for testing on that band.

side arrays. These conclusions are based upon the reference cited above.

Figure 2(normally I'd have included this photo in the construction section, but it exemplifies proper winding data, here) shows my first torodial coils. This was for general coverage use, with reception coming in on virtually all high frequency bands, and particularly, WWV. My design used No. 24 wire, wound fully in bifilar manner on the toroid cores. This is a 1:1 design ratio.

It was a rainy day when this shot was taken, so it is hard to see the input port cable connection in the middle-left with a cut piece of RG-58/U soldered on. The wire connections have been bared to show cores and the aluminum ground wire connections. The aluminum was swaged and wrapped to the smaller wire ends and held together with a plastic rod, through the cores, and the whole works doused in clear epoxy resin. This receiving design resulted in antenna resonance at 11 MHz; however there was excellent pickup an octave higher at 22 MHz and beyond. Lower-octave reception down to 5.5 MHz was quite good! To the nearest amateur band: 15 meters is recommended, while *reception* of WWV at 10 MHz should be "optimum."

Practical Antenna Construction

Figure 3 shows an improved 50 MHz set of quadrature coils. Note that they are similar to a five port circulator, having four output ports in common with earth ground, back to the antenna structure, when connected. The input port doesn't share the same phase of any of the output ports with ground, so there is reasonably good balance without an external balun. It can be shown that the balancing action from the worst two on any pair of wires is +90/Ground Isolated/ -90 basis. You can see the total phase difference is still 180 degrees, but the coaxial cable "ground" is not the same as earth ground.

Figure 4 shows an improved 50 MHz array, as strung up in W4KAE's attic. The elements are mounted in a vertical plane but the reception or transmission is horizontal, as would be expected. This antenna was loaded by my TX-62 on 6 meters giving an swr of 1.5 to 1, in the basement laboratory. By making it "droop" like the drooping ground plane (not illustrated) the swr went down to 1.3 to 1.0. A drooping TQA hanging from a set of square supports should

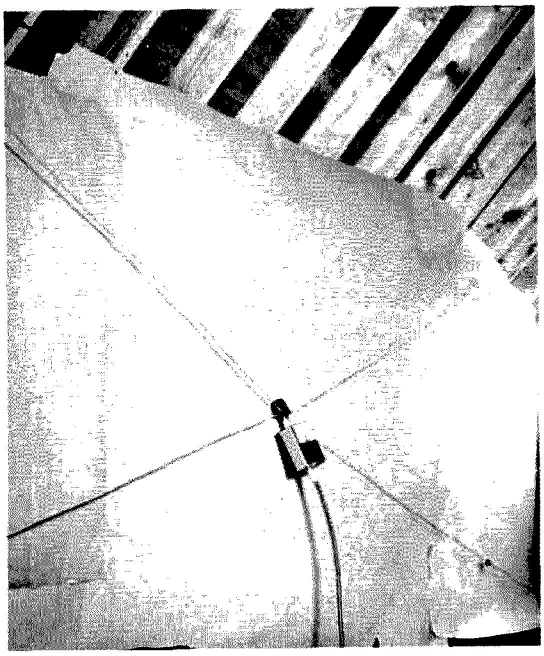

Fig. 4. The completed 6 meter Toroidal Quadrature Antenna. Individual leg lengths re about 6 2/3 ft. Swr about 2 to 1 with legs not equally angular spaced. (When first tested in my basement lab: swr was only 1.5 to 1. Drooping will improve readings.)

out-perform a "Halo, Squalo, or even Big Wheels," on VHF.

Figure 5 shows the TQA in packaged form ready to be sent to the editorial research department of *73* Magazine! The toroidal coils are heavily potted in silicon rubber, with an overcoating layer of Valspar No. 8880 glass plastic resin. (This clear resin is no good when in intimate contact with coils, toroid cores or any dielectric use.) In the Valspar resin flat 1/8 in. copper strap is secured, after being soldered. Then the molded network was taped to help secure mechanical strength. Prior to taping, the copper strap was silver-soldered to silver-plate No. 10 ground wire.

Fig. 5. The TQA is ready to be shipped. The entire antenna and insulators are easily contained in an old shoe box. With aluminum ground wire elements, the weight was very little.

Toroidal Core Materials

The toroidal phasing coils are made with Permacor Material No. 12, Carbonyl SF powdered iron mouldings. The stock number is 57-1736. They are available from *Permacor Division of Radio Cores, 9540 S. Tulley Ave., Oak Lawn, Illinois,* on a $10.00 minimum order basis. It may be possible to get several samples free, by writing on your company letterhead.

With the No. 57-1736, six meter networks can be made by winding bifilar two lengths of No. 16 enamel wire (Formvar preferred), covering all the core space possible. For 10 to 20 MHz, a full bifilar winding of No. 24 enamelled wire is permissible, but the coils will only take 100W PEP or so. For 160 meters and/or 80 meters, Permacor No. 57-1516 is a good choice since it is considerably larger.

If good VHF/UHF networks are desired I must recommend ferrite – not powdered iron – cores. Indiana General makes a very high quality core, size CF-111-Q3 which is almost identical in size to the Permacor 57-1736. I do not know where these can be obtained. In the meantime X-7541 cores are in use at W4KAE (Permacor Iron-9) – but I am anxious to try the Q3 material. For two meters, with the CF-111 size ferrites, wire size should be No. 14.

Conclusion

At the outset I mentioned the LCQ in opening remarks about the TQA. This is because they are both new departures in contemporary antenna design. The LCQ: A Yagi replacement at least for UHF; and the TQA is a 40 or 80 meter quad or rotary beam replacement. It can also be used on 160 – if you have the room.

It is my opinion that the cubical quad antenna, as already perfected, is ideal for use on 10, 15 and 20 meters – also for 6 or 2 unless you want broad angular coverage. Then the TBA is still practical when wound with good ferrite cores. DXing on 6 meters is still best accomplished using 11 element Yagi designs, I hear; however I'll be glad to recommend my LCQ to home-brewers.

Although the 6 meter design is featured in this article, it is primarily an HF antenna replacement for rotaries when used N/S or E/W in array. With two medium height aluminum masts we can string up a wire element replacement for the Inverted Vee – or – it can be used as a 4 wire Vee that is completely omnidirectional, with only a single set of coils! It will also work on at least one octave of frequencies, on a reciprocal basis, or two octaves in the receiving mode.

. . .W4KAE

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APPLICATIONS FOR AN ACTIVE FILTER

Most experimenters are familiar with the effects of cascaded phase shifters applied to the feedback loop of an amplifier. A useful feature which ends up as a very sharp filter can be the result.

In most applications it has been used in audio work as an accessory to a receiver for CW work. I have been able to study further the usefulness of this device at audio and radio frequencies and would like to present the results for what they may be worth to other amateurs.

When the interest in Teletype was at its peak at W1SNN, construction of a converter led to many tries until a satisfactory unit evolved.

The unit was similar to the many published designs with the exception of the filter. Two active filters were constructed which were incorporated in the converter and the improved selectivity made copy considerably more legible. A plot of these filters is shown in Fig. 3a. The circuit of the filter is shown in Fig. 1.

The active filter is not restricted to audio frequencies. During the development of the filters, the center frequencies were extended over a range of 2 kHz to 1 MHz.

A Table, Fig. 2, indicates component values for the individual filter electronics; Figs. 3b and c are presented to show the response of plots for single filters and a cascaded pair stager tuned to produce a symmetrical pass band with a very respectable shape factor at 80 kHz.

An overall gain of 40 dB can be achieved by setting potentiometer Ra to a point well below a level which will make the filter regenerative.

Two potentiometers ganged and connected as part of the network marked Rb and Rc can serve to adjust the center frequency of the filter if an adjustable filter is required. To accomplish good tracking of these two potentiometers, it was necessary for their values to be a very small percentage of the total resistance for Rb and Rc. Therefore it goes without much further discussion that wide frequency excursions are not permissible for a fixed filter.

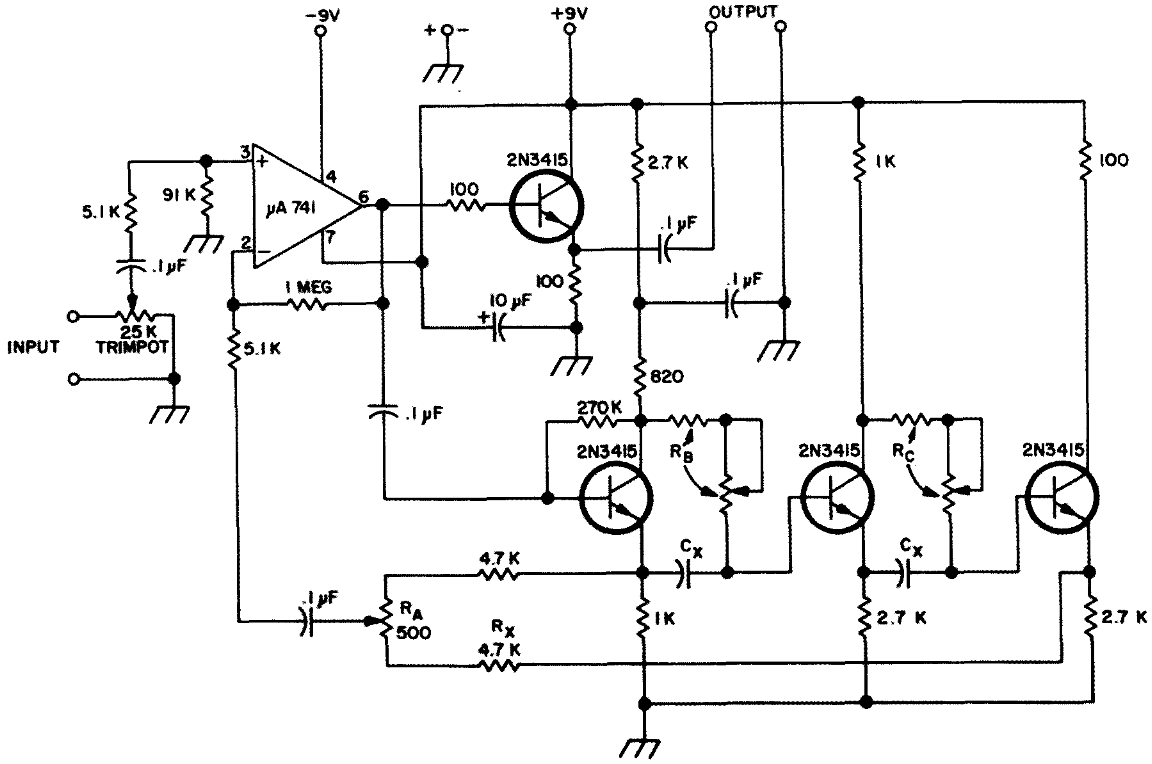

Fig. 1. Phase shift network active filter.

The method just described is used in a receiver where the filters are used in a second conversion (i-f) amplifier. The filter is adjusted so that it passes either a lower or an upper side band by simply a turn of the ganged pots. Selectivity can be sharpened by adjusting Ra for narrow or wide band widths. In my application, a range of 200 Hz to 4 kHz was required.

Some care must be used in construction of these filters at frequencies above 30 kHz. Regeneration will occur if the lead lengths are too long for any of the three potentiometers. It is better to group the pots in a row on a small piece of vector board and build all components around the potentiometers than to run wires to them.

The components used are inexpensive plastic transistors. All resistors and by passes are non-critical. If a frequency above 85 kHz is required a 702 operational amplifier should be used in place of the 741.

The overall gain of each filter is very high (40 dB), therefore, very little signal is required and is controlled by the 25K trim pot at the input of the filter. The output of the filter is decoupled through an emitter follower. In our case a 100Ω output impe-

f, kHz	Rb	Rc	Cx	Gain	3 dB Bandwidth
2.125	200K	200K	370 pF	45 dB	350 Hz
2.975	140K	140K	370 pF	44 dB	380 Hz
10.	50K	50K	330 pF	44 dB	1.4 kHz
50.	10K	10K	300 pF	44 dB	2.4 kHz
60.	11K	11K	300 pF	48 dB	2.0 kHz
85.	15K	15K	100 pF	44 dB	2.0 kHz
100	15K	15K	90 pF	44 dB	2.5 kHz
1 MHz	5K	5K	30 pF	36 dB	4.5 kHz
5 MHz	1K	1K	30 pF	27 dB	8.9 kHz UNSTABLE

Fig. 2. Table of values for a phase shift filter.

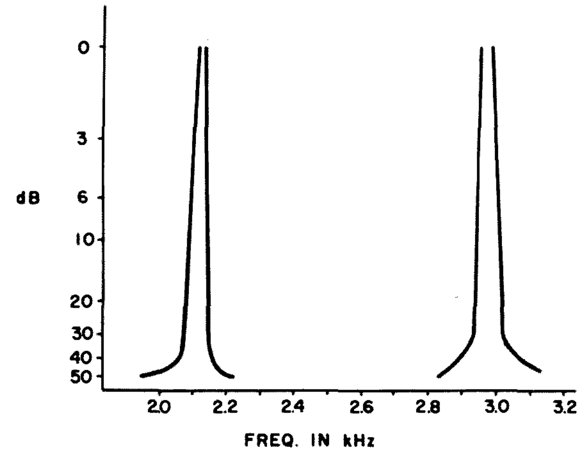

Fig. 3a. Plot of discriminator filter for W1SNN RATT converter.

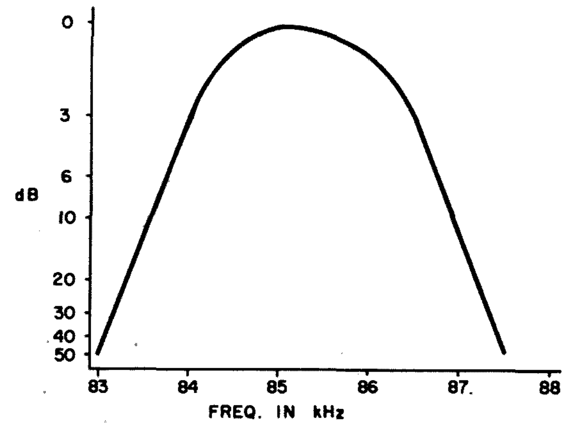

Fig. 3b. Single phase shift filter.

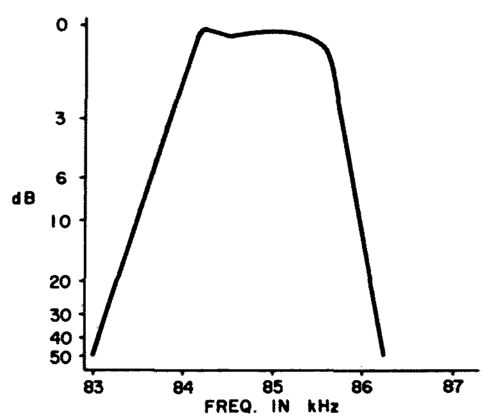

Fig. 3c. Cascaded pair phase shift filter.

dance was required, but higher values can be had by simply changing the value of the emitter resistor.

Do not try to drive a high level signal into this filter, 3 mV in produces 0.3V out, which is sufficient to drive any detector.

A maximum of 12 volts should never be exceeded for the supply voltage; 9 volts is best from a battery since current drawn is very low.

To adjust the filter, first connect a VTVM rf probe to the output; adjust the potentiometers R and Rc to the middle of their ranges; set Ra to about one-third open. If the unit has output with no signal in . . . readjust Ra until it just stops oscillating. Now apply a weak signal from a signal source tuned to the desired center frequency. If no indication of a signal is shown on the meter, sweep the generator slowly through the range of frequencies around the desired frequency. Do not increase the generator level. A signal will be indicated by a very pronounced upswing and over a very narrow range. By adjusting Rb and Rc ganged pots you will be able to center the filter on your desired frequency.

If you find Ra will cause oscillation to occur when it approaches its full-on value, change the value of the series resistor Rx to a higher value, probably, not more than 470Ω more. This adjustment allows control on selectivity or the filter bandwidth before oscillation occurs.

So far we have described only one filter. If a wider bandwidth but a sharper roll off is desired, cascading two of these filters in a stagger tuned configuration will produce the effect.

Greater reduction in signal level will be required. The trim pot at the inputs should be barely open to reduce the input signal for each filter. The use of potentiometers to adjust each filter gets very touchy and fixed values are recommended.

Tune up procedure will be the same as for one filter but now each Rb and Rc value will require trimming each resistor by paralleling with other fixed values.

In this application Ra can be a trim pot set to produce the selectivity response required.

. . .W1SNN

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TIME-FREQUENCY MEASURING SYSTEM PART II DESIGN THEORY AND CLOCK

This is the second of a three-part series describing the design theory of a time/frequency measuring system for a well equipped amateur radio station and workshop. The heart of the time base is the master oscillator. For the expected accuracy and stability, a crystal oscillator, with the crystal in a temperature-controlled oven, is necessary and sufficient. A crystal oscillator not using an oven might be made to hold to within one part in 10^6 with careful temperature compensation and a bit of experimentation, but remember that that is the very worst stability we can use. A simple crystal oven, and reasonable care in construction of the oscillator, can achieve stabilities better than one in 10^7, which is consistent with our goals. More exotic techniques, with double ovens (one around the whole oscillator), can yield crystal oscillators with stabilities measured in parts in 10^9, but these are beyond the needs of most amateurs.

Any oscillator consists of an amplifying element and a feedback element, as shown in Fig. 2. The amplifying element must have a stable gain great enough to provide a usable output power without loading the feedback element, and the feedback element must put just enough of the amplifier's output back to the input to sustain that output, but only at the desired operating frequency. The multiple-amplifier integrated circuit packages provide the most convenient way to get the stable forward gain needed. The RTL and DTL circuits are intended for digital applications, but when biased into their linear operating regions make good high-gain linear amplifiers. The more popular TTL circuits tend to be unstable as amplifiers but work ok as oscillators. I used a quad NOR gate in this application because I happened to have one, but other gates might work.

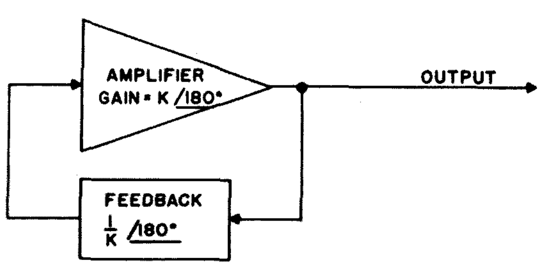

Fig. 2. Oscillator block diagram.

The feedback element is, of course, the crystal, operating as a parallel resonant filter. I chose an operating frequency of 1 MHz, because I happened to have a crystal for that, but a crystal on any frequency between 1 and 10 MHz designed for a stability of one part in 10^6 per week over the temperature range provided in the chosen oven will be adequate. It is difficult to get crystals of the necessary stability lower in frequency than 1 MHz, and the cost is much higher below about 5 MHz. The chosen frequency should be a multiple of only the numbers 2, 5, 6, and 10 (like 4 MHz = 2 x 2 x 10^6, or 5 MHz = 5 x 10^6), otherwise the dividers will have to be specially designed.

A fine trimmer adjustment must be provided on the oscillator with a no-backlash calibrated vernier control. Because adjustments will be made to the oscillator that will not show up until a week later, the operator must be able to tell exactly how far and in what direction he is adjusting. The calibrations don't have to be in Hz, but do have to be in linear repeatable units so that if, for

example, a correction of one unit reduces the drift from 0.5 to 0.4 seconds per week, then four units of correction in the same direction should put the oscillator right on. I used a vernier control giving 100 divisions for 1/2 turn of the trimmer capacitor, and about a five-to-one speed reduction from the knob.

Divider Chain

The oscillator is tied to the clock through a divider chain, as shown in the time base/clock diagram, Fig. 3. The purpose of this chain, of course, is to divide the oscillator frequency until it has a frequency useful for the devices to be connected to it. Integrated circuits are available for dividing by 2, and multiples of 2, 5, 6, or 10. Other division ratios may be implemented, but not as conveniently. The 7490 decade divider IC chosen for my project has two independent dividers, a by-2 and a by-5. These are normally cascaded, or the signal run through both, to get divide-by-10. If it is being used as a counter, the signal must go thru the by-2 first and then the by-5 to make the numbers run in the right order, but if it is only being used as a divider, the signal may go thru the by-2 last. This has the advantage that the output signal is a symmetrical square wave, which is a little nicer for use as a clock signal.

Line Drivers

The output signals from all of the above mentioned divider IC's are zero and four volt logic levels, which may be driven directly into any of the other IC's. If these signals are to be transmitted via coaxial cable outside the unit, however, some buffering must be done. The reason for this is that the low impedance of standard coaxial cables places too heavy a load on the IC circuit. Even if they could drive the load, a four-volt swing on a 50Ω cable is an unecessarily large amount of power to use just to transmit a clock signal. To mitigate these conditions, I use 90Ω RG-62 cable for all interconnects, and extra gates for signal isolation.

Clock Speed Control

In order to set the clock to the correct time and synchronize the change of seconds with standard time, some sort of clock control must be provided. The most convenient system to use requires a full set of digit switches and parallel-load button, plus an interrupt control to stop the clock. In use, the operator sets into the digit-switches a time that is coming up, stops the clock, and loads the set time into the clock. At the instant the selected time occurs, he restarts the clock, and it is synchronized. Unfortunately, the digit-switches are bulky and expensive, so I did not use this method.

The system I used is less convenient to use, but then the clock does not need to be set very often. I provided a rotary selector switch which selects clock speeds of Off, Normal, and up to 10,000 times normal speed. This fastest speed will run the clock through its full 24-hour range in 8.6 seconds. In use, I set the clock by running it at high speed until it gets to the time I want, switch to OFF to wait until that time comes up, then switch to NORMAL speed. The switch is controlling the 10 Hz point in the divider chain, so the clock can be synchronized to within 100 milliseconds.

Clock Counters

As may be seen in the clock diagram, Fig. 3, a separate counter IC package is used for each digit of the clock, except the tens of hours. A 7490 decade counter is used for the units of seconds, units of minutes, and units of hours digits, all of which count modulo-10 (0 to 9, then back to 0). The leftover divide-by-2 parts of the 8288's are combined to make a 2-bit divide-by-4 for the tens of hours decade. This makes a basic 40-hour clock.

To make the clock recycle at 24 hours, that time is recognized by a detector gate, which then resets (clears) the clock to zero. Actually, most of the clock is already zero, so only the tens-of-hours 2, and the units-of-hours 4 need to be reset. A *nand* gate toggle buffer (simple flip-flop) is used to store the reset signal until it is itself cleared four seconds later. This storage is necessary because the reset signal is removing the signals which cause it by resetting the clock, and a race around the loop would occur without the storage. The four seconds is purely arbitrary. I used the units of seconds 4 line because it was handy; any signal that switched on between midnight

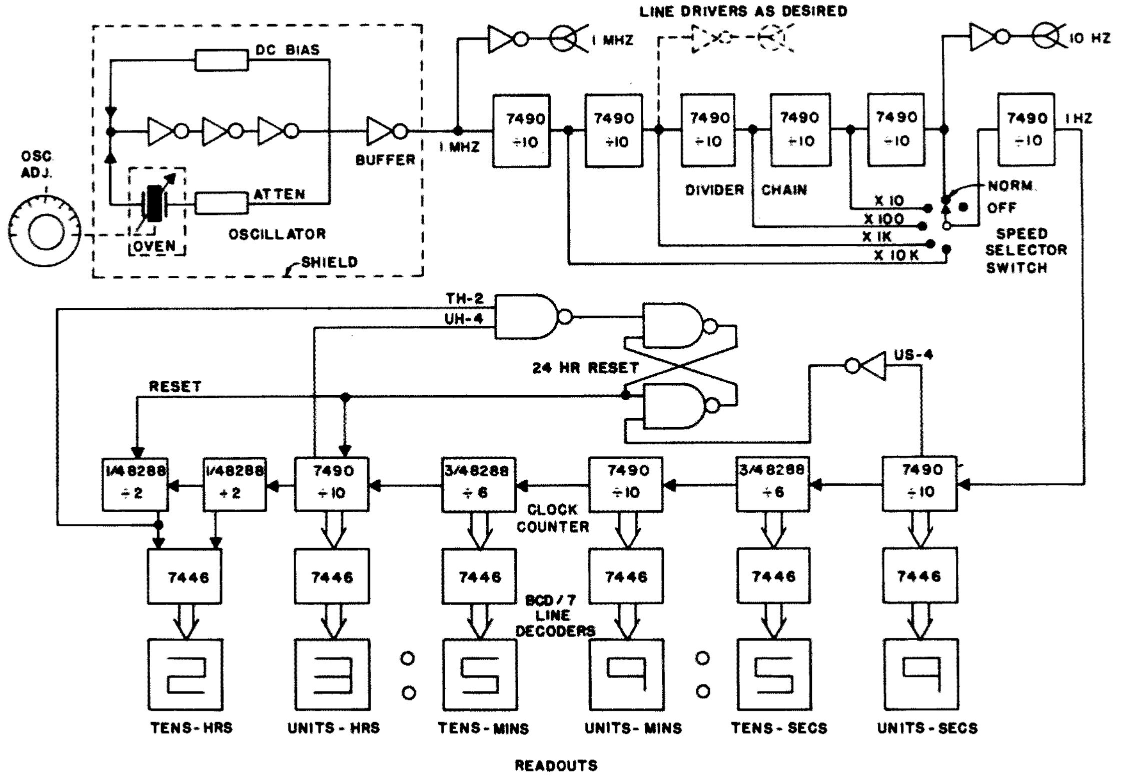

Fig. 3. Clock/time base block diagram.

and ten seconds later would have worked. The reset signal must be cleared within ten seconds because the reset for the tens of hours 2-bit is also holding down the tens of seconds digit, which shares the same 8288 IC.

Decoders and Readouts

The decoders must be chosen to drive whatever readout the builder chooses. Seven-segment readouts such as I chose are the most economical incandescent readouts, but the builder may have other kinds from surplus sources. Nixie tubes are also economical, but require a high voltage power supply.

The 7446 decoders I chose match the seven-segment readouts with 24 volt incandescent bulbs that I used. These decoders will stand 30 volts and switch 40 mA. I run the lamps with 12 volts; they are bright enough to read easily and the life of the bulbs is extended greatly. If the builder used lower voltage bulbs, he may use the 7447 decoder, which has a 15 volt rating. However, if the lamp current will exceed 40 mA per lamp, it will be necessary to use the 7448 decoder (which pulls up instead of down at the output), and a buffer transistor in the line to each lamp. This can be any cheap NPN such as a 2N5129. The connection for this is shown as an alternate on the schematic.

If the builder uses ten-line rear-projection readouts, which are sometimes available as surplus, he will need 7442 decoders. If he uses Nixie tubes, he will need 7441 decoders.

Power Supply

The circuitry used draws a substantial amount of current at 5 volts dc, plus an even larger amount for the readout lamps, which may also be 5 volts, plus power for the oven heater. All of these loads are varying; each number showing on the display uses a different number of lamps, and the various counts that appear from time to time in the counters draw different currents. A good voltage regulator can eliminate any problems arising from this, and I would not suggest that anyone consider getting by without one. IC regulators are available for a few bucks with all the features one would want (voltage regulation, current limiting, short circuit protection, etc.) from several manufacturers, including National and Fairchild.

The National LM 309K I used, for example, is in the standard diamond power transistor case, takes in 6.5 to 35 volts or wave forms with ripple between those limits, puts out 5 volts at up to 2 amp., is short-circuit-proof, and just bolts directly to any grounded heat sink. All that costs around $4, and no one can affort to design and build a regulator with that kind of thing available.

The rest of the power supply is a transformer-rectifier to supply 12 volts dc for the regulator, a lamp supply, and a shunt regulator for the standby batteries. My lamp supply is very simple, being just another set of rectifiers from the same power transformer, because I used 12V lamps. If other voltage lamps are used, a separate transformer will probably be necessary, but separate rectifiers should be used in any case, to prevent the heavy lamp current from loading the filter capacitor. The lamp power does not need to be filtered.

The standby batteries are connected in parallel to float across the unregulated 12 volt line. This simple connection would be adequate to keep the batteries charged and provide standby power for the 5 volt regulator, except that the voltage can rise high enough to overcharge the batteries. The simple shunt regulator I used limits the peak unregulated voltage to about 14 volts, which a 12 volt storage battery can stand almost indefinitely.

Batteries

The floating-battery scheme used here is appropriate for lead-acid type batteries. I use a motorcycle battery, which has the capacity to run the clock for several hours. It has the drawback of having the acid fume and spillage worry of that type of battery. A better choice would be a sealed battery of the type made by Centralab under the name GelCel. The Nicad batteries look very attractive, although high-priced, but they require a different charging scheme than I have provided here, that is, constant current instead of constant voltage.

RFI Considerations

Digital circuitry of the type used in this unit generates large amounts of wideband, high-frequency noise. The reason for this is the very thing that makes TTL logic so good: it works very fast. Whenever a gate switches, the resulting square voltage waveform has harmonics spread out well into the VHF region. For this reason, all digital devices to be used near radio equipment should be built in shielded enclosures, at the very least an all-metal cabinet, and all wires leading in or out should be shielded or filtered. Normal techniques for TVI-proofing a transmitter will serve here.

Three of the NOR gates in the LU380A package are connected in cascade to form the amplifier portion of the oscillator, as may be seen in the Time Base Schematic, Fig. 4. The input to this amplifier is pin 10, and the output is pin 2. The last gate is used as an output buffer, from pin 4 to 3. There are two feedback paths, one for dc stabilization, and one for the rf signal. R4 and R3 provide enough negative feedback bias to stabilize the amplifier in its linear region. R3 is to be adjusted to get a symmetrical square wave from pin 3. C8 bypasses the rf to ground so that only dc is fed through this path.

The crystal Y1 and capacitors C3, C4 and C7 are connected to form a 180° phase shift and voltage step-down network, as used in a Colpitts oscillator. C4 is a fine trimmer across the high-impedance side of the network to adjust the frequency, and is the Frequency Adjust Control mentioned in Part I of this series The amplifier output is attenuated by R2 and C6, then lightly coupled to the high-impedance side of the crystal network through C5 to keep the crystal voltage as low as possible. The output from the low impedance side of the crystal network is connected back to the amplifier input to complete the loop. The amplifier output is to be coupled as lightly as possible (smallest value of C5) and still maintain oscillations.

You might get by without shielding the oscillator, but I consider it a worthwhile precaution to isolate the oscillator from outside influences. I enclosed the whole oscillator in a brass strip fence, as can be seen in the photo. All the capacitors associated with the crystal network (C3, 5, 6 & 7) must be high quality stable types such as silver mica. C4 must be a good grade VHF type trimmer.

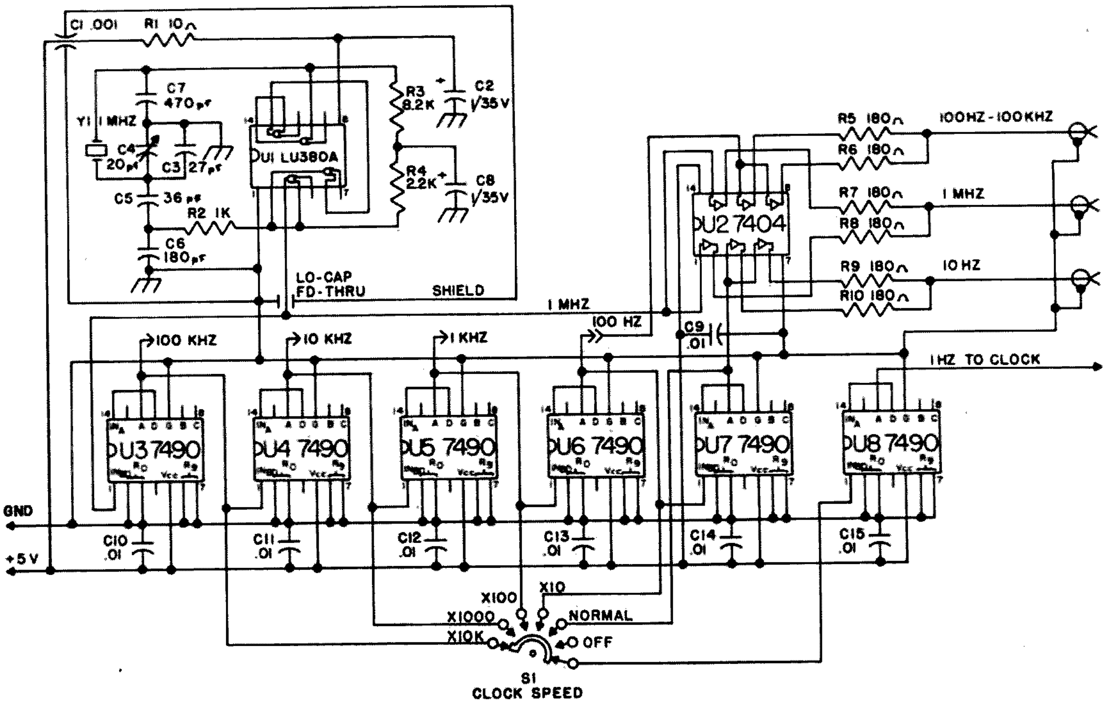

Fig. 4. Time base schematic diagram.

Divider Chain

The divider chain consists of a string of decade dividers, each reducing the operating frequency by a factor of ten. Each is connected with the divide-by-five ahead of the by-two portion to give a square wave output. The input signal enters at the divide-by-five trigger port (labeled IN_{BD}). The output of this section (labelled D) is connected to the trigger of the divide-by-two section (labelled IN_A). The output labelled A is then the square wave.

The B and C outputs are not used and are left open. The reset-to-0 and reset-to-9 inputs are not used in the divider chain and are grounded. Inputs left open will assume a logic 1 (high) state, which in this case would hold the counters in reset (0) state.

The A output of each divider goes to the IN_{BD} input of the next divider in each case, except the 10 Hz line between U7 and U8. This line goes through the Clock Speed Switch S1 in the NORMAL position. In other positions, the input to U8 is tapped from the output of dividers running at higher frequencies to speed up the clock, as explained previously.

Bypass capacitors C9–15 are required because of a characteristic of the TTL IC's used; these devices draw a large amount of current for a very short period of time while they are changing state, appearing as a current spike on the Vcc line. Due to the inductance in even a short piece of wire feeding the supply voltage to the IC, this current spike can produce bad voltage surges. The cure is simply a small capacitor directly across the supply terminals of each device. This is a small price to pay for the high performance of the TTL logic family.

Line Drivers

U2 is a hex inverter used as an isolation amplifier for driving coaxial lines. Two amplifier sections are used in parallel to drive a 90Ω coaxial line (RG-62 cable) through isolation resistors. These 180Ω resistors in parallel give an effective 90Ω output impedance and keep the load on each amplifier within its 10 mA rating. One IC provides three output lines. 10 Hz is needed for frequency counter, 1 MHz is a useful output for initial oscillator checks, and the other line may be connected to whatever frequency is desired between 100 Hz and 100 kHz. To bring out all the possible frequencies would require additional hex inverter packages.

Clock Counters

The clock counters consist of a divider IC for each digit of the clock except the tens of hours, with a 24-hour reset circuit to switch the clock back to zero every midnight, as may be seen in the Clock Schematic Diagram, Fig. 5.

The units of seconds (U14), minutes (U12), and hours (U10) counters are decade dividers connected in the standard manner for this device. That is, the input signal triggers the divide-by-2 A section first, and then the by-5 BCD section to produce the standard binary-coded-decimal (BCD) counting sequence for which the decoders are designed. Therefore, the ABC & D outputs are connected to the ABC & D inputs of the decoders respectively, The D, or last, output drives the input of the following stage.

All the reset inputs on the units digits are unused and grounded, except the reset-to-zero for the units of hours. This is connected to the reset line, as shown in Fig. 3, to clear the four in the twenty-four hours.

The tens of seconds and tens of minutes digits use the divide-by-six BCD sections of U13 and U11 IC's respectively. Because these represent the ABC bits of a modulo-six digit, the BCD outputs of these counters are connected to the ABC inputs respectively of the corresponding decoders, U19 and U17. The reset-to-zero input of U13 is connected to the reset line, all others being grounded.

The leftover divide-by-2 A sections of U13 and U11 are used to make the two-bit tens of hours digit. The U11 A section is the TH1 bit and the U13 A section is the TH2 bit. Therefore, the D output from U10 drives the A input of U11, and the A output of U11 drives the A input of U13. These two A sections are connected to the A & B inputs of the tens of hours decoder U15, representing a two-bit number to that decoder. The other decoder inputs are grounded.

The quad *nand* IC U9 is connected to implement the 24-hour reset logic, which may best be seen on Fig. 3. The number 24:00:00 is recognized by the gate at pins 8, 9 & 10 by the presence of the TH2 and UH4 bits in the high state, which then sets the *nand* toggle made up of the gates at pins 1 through 6. The toggle puts a high state on the reset line from pin 3, which resets to zero U10 and U13. The next US4 bit is inverted by the gate at pins 11–14 of U9 and then used to clear the *nand* toggle.

Decoders and Readouts

The common terminal of the readouts is connected to the lamp voltage from the

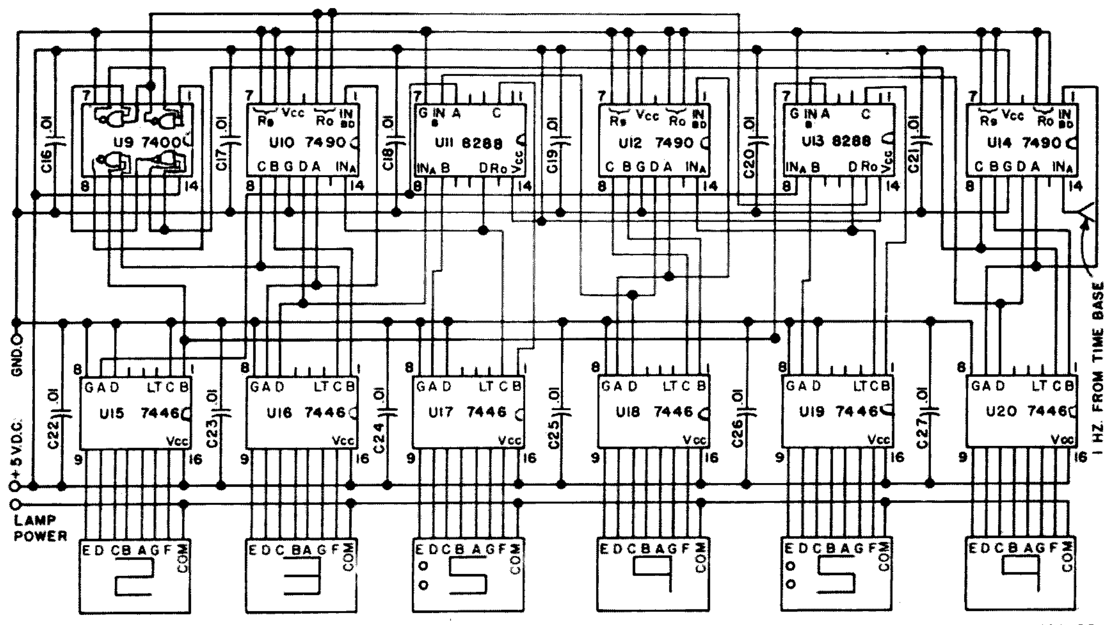

Fig. 5. Clock schematic diagram.

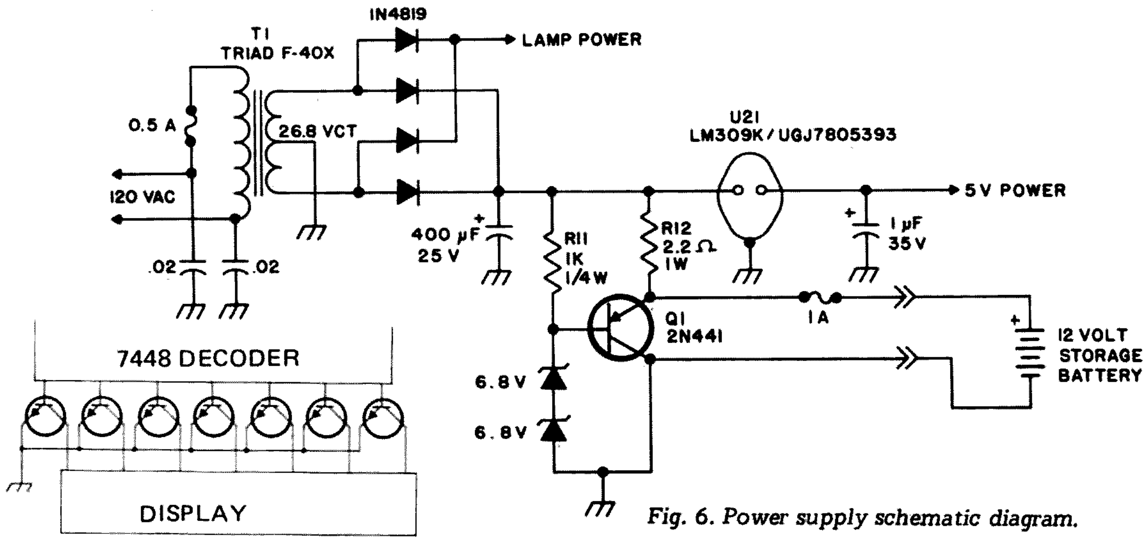

Fig. 6. Power supply schematic diagram.

power supply, and the lamp of each segment in the display lights as its line is grounded by the decoder. The decoder lights the combination of lamps making the numeral corresponding to the binary code fed to it from the counter.

The pin 4 & 5 connections to the decoder are for blanking of unused numbers and have no function in a clock. Because they are active in the low state, they may be left open to be inactive (high).

The input at pin 3 of the decoders is for lamp testing. I didn't use this, but one could tie all these pin 3's together to a bus line and ground it with a push-button to make all 8's appear in the display, thus testing all display segments. This would not be a very useful frill, but it wouldn't cost much either.

An alternate connection for lamps drawing more than 40 mA is shown in the corner of Fig. 6. This uses a 7448 decoder and seven NPN switch transistors. The 7448 has output pull-up resistors for direct connection to the transistor base.

Power Supply

The power supply for the IC's uses a transformer with center-tapped secondary, full-wave rectifiers, and capacitor filter of the simplest type, as can be seen in Fig. 6. The filter capacity shown allows several volts of ripple and is thus very easy on the rectifiers, but the regulator IC U21 changes this to as pure dc at 5 volts as one could desire. About one µF of filter capacity should be on the output of the regulator, but this can be at the load, or almost anywhere on the 5 volt bus, as it is to bypass low-frequency transients.

The lamp power is derived with a separate set of rectifiers to prevent loading the filter capacitor with the relatively heavy lamp current.

The shunt regulator I used is fairly crude and non-adjustable, but is doing its job quite adequately. The two 6.8 volt zener diodes provide a 13.6 volt reference voltage for the base of shunt regulator Q1. Whenever the emitter of this PNP transistor exceeds 0.3 volts higher than this, or about 13.9 volts, the regulator begins to shunt current to ground to hold the voltage at that level. The 2.2Ω resistor R12 is chosen to limit charging current to the battery to about 1/2 ampere when the battery is low, i.e., about 11 volts terminal voltage. R11 is not at all critical, and only provides some keep-alive current for the zener diodes when Q1 is not conducting.

...K5DUS

YOUR CALL

Please check your address label and make sure that it is correct. In cases where no call letters has been furnished we have had to make one up. If you find that your label has an EE3*&* on it that means we don't know your call and would appreciate having it.

Clifford Klinert WB6BIH
520 Division Street
National City CA 92050

REPEATER KEYING LINE CONTROL

A circuit for controlling timed functions in a repeater. The use of the new Signetics NE555 IC timers eliminates electronic and mechanical complications.

Every repeater has a need for two basic timing functions. The first is the delayed drop out. A short time delay between the release of the COR and the transmitter drop out is necessary to prevent the transmitter keying relays from chattering on a signal that is fluttering in and out of the repeater receiver. This short delay, usually approximately two seconds, will prevent the annoying chattering noise and prolong the life of the equipment.

The second function is usually called the time-out-timer or transmit-interval-timer. Occasionally someone will accidentally or deliberately leave his transmitter keyed up on the input channel of the repeater. If the transmitter in the repeater is not rated for continuous service, it may overheat or be damaged. If for some reason, the repeater cannot be controlled under these conditions, this can cause severe anxiety for the person who must either wait for it to go away, or drive a hundred miles in the mountains at night to solve the problem.

Many repeater systems use surplus time delay relays, coffee pot trimmers, or other mechanical contrivances. These devices may be either unreliable or expensive.

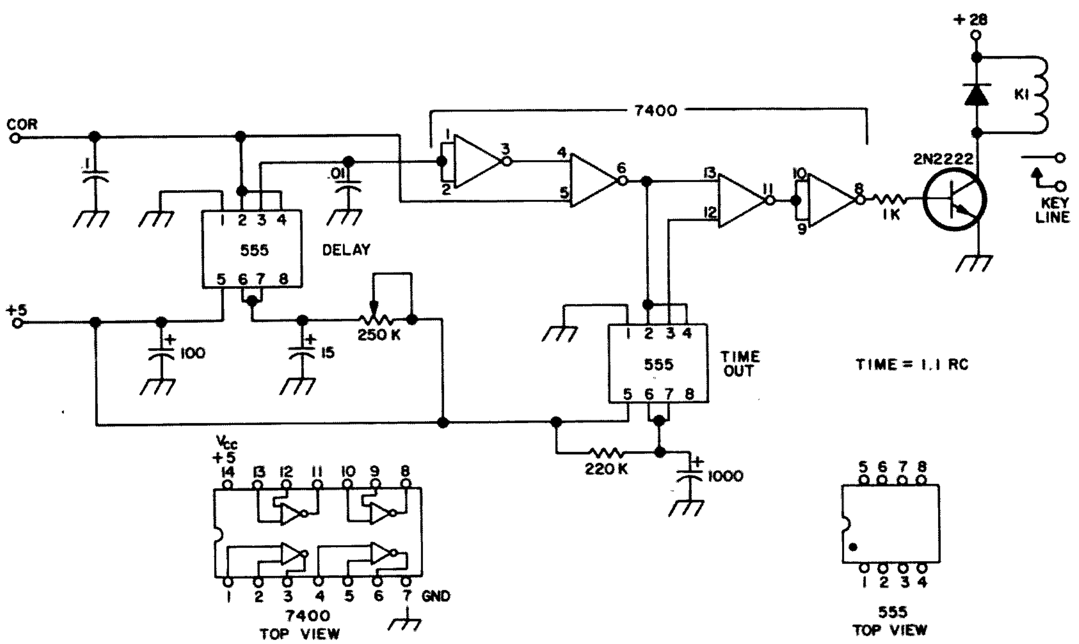

Fig. 1. Schematic diagram of the repeater control circuit using NE555 IC's.

Integrated Circuits

The device to be described in this article uses three integrated circuits that are reliable and inexpensive. A few resistors and capacitors set the time intervals for the two Signetics 555 timers. A 7400 quad dual input nand gate performs the required logic functions. A transistor is used to drive a relay in the output circuit. The completed unit is connected between the repeater receiver COR contacts and the repeater transmitter keying line.

Construction Notes

Any available method of construction can be used since the layout is not critical. A piece of perforated circuit board makes a good chassis for hand wiring. With the pins on the ICs inserted in matching holes in the boards, wires can be stuffed into the same holes alongside the IC pins for soldering. Teflon insulated wire is a must where repeated soldering and unsoldering may be necessary to correct solder bridges between pins. Making a printed circuit board is not recommended since such a one-of-a-kind project usually does not justify the trouble and expense.

The integrated circuits and data sheets for this project were obtained from Solid State Systems, Inc. Capacitors with polarity markings were electrolytic. The .1 and .01 μF capacitors can by mylar or disc ceramic. These two capacitors were necessary to prevent radiated noise from triggering the timer. Other precautions may become necessary under different conditions.

Note that the top view of the pin connections for the 555 in the schematic are numbered differently from the usual convention. This numbering was given with the application information, but the normal convention was given on the data sheet. The numbering shown in the schematic was used, and the circuit operated this way.

The output circuit shows a transistor driving a relay. A 2N2222 switching transistor can be used to drive a 28 volt crystal can relay coil. The contacts of these relays will typically handle up to two amperes. A silicon power diode must be placed across the relay to protect the transistor. A 28 volt lamp can also be used for this purpose while providing an indicator light, if the transistor can handle the extra current. Other combinations of transistor and relay may be used if the transistor has enough dc gain to be fully turned on by the IC output. The IC should be able to provide more than 10 mA, and as much as 50 mA short circuit current. A resistor is placed in the base of the transistor to limit base current to no more than what is necessary to saturate the transistor.

A plug-in relay can be used to provide for easy repair of the only probably cause of failure in the circuit.

Setting Up

Once the circuit is completed, the drop out delay time can be adjusted with the 250K variable resistor. The time-out timer is not made adjustable, but the 220K resistor or the 1000 μF capacitor can be changed to select different time constants. Longer time constants may be difficult to achieve because of the leakage resistance found in most large electrolytic capacitors. The components used resulted in a time-out delay of almost ten minutes although the theoretical time constant would be only about four minutes. This is because the leakage resistance in the capacitor counteracts the timing resistor. If the leakage is bad enough, the timer will never time out.

No power supply is shown in the schematic, but voltages can be obtained from a dropping resistor and zener diode from the repeater's 28 volt power supply. If a special separate power supply must be built, there are many integrated circuit voltage regulators that can make the project very simple.

Final Comments

The integrated circuits cost just over three dollars at the time of this writing, and prices have been decreasing steadily. The circuit gives solid state reliability with the exception of the output relay which can be made easily replaceable. Anyone who is putting up a new repeater should consider making this simple circuit a part of the control system right from the start, but if the machine is already up, its never too late for improvements.

. . .WB6BIH

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POPULAR SLOW-SCAN TELEVISION CIRCUITS

PART I

This article presents a description and analysis of some of the circuit elements commonly used in slow scan gear. The data presented will be very useful to those wishing to experiment with different circuits but a light reading will provide you with some of the basic circuit functions. A thorough understanding of the material presented here is not essential to build and operate the circuits to be presented later, but it is presented for easy reference if you desire to go a little deeper into the various circuit functions.

Operational Amplifiers

If one could pick a single electronic component that was the most valuable to a slow scanner, it would be an operational amplifier. The op-amp is an integrated circuit consisting of many transistors. It has high gain in excess of 100,000. It can be connected to external circuits to perform a wide variety of electronic functions. This discussion will avoid some of the shortcomings of these amplifiers and concentrate on the usefulness of the economical and readily obtainable devices.

In order to simplify the discussion as much as possible, just two types of amplifiers will be discussed. These two types were first introduced by the Fairchild Company, but they are also now being made by a great number of manufacturers. These two op-amps are the 709 and 741. The 709 is the original uncompensated op-amp and, since it has been available the longest, it is the lowest priced. Compensation refers to external capacitors and resistors added externally to control the roll-off of the frequency response. The many uses of the op-amp call for different compensation, so care must be taken to use the correct capacitors and resistors.

The 741 is a universally-compensated amplifier that requires no external resistors or capacitors. It also has some superior breakdown and operational characteristics that make it a bit more reliable than the 709. The designs described in this handbook will use either 709's or 741's.

Op-amps can be purchased in three or four package styles. These are the TO-99,

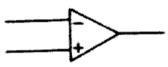


Fig. 2-1. Symbol for op-amp.

flatpack, dual in-line package or DIP, and a shorter DIP called the mini-dip The TO-99 package looks like an ordinary transistor with many leads. The flatpack is very hard to use since its leads are difficult to fasten down unless the designer had developed a special socket PC board mounting. The DIP is our favorite. It lends itself to sockets or to 0.1 mill vector board. They come in a 14-pin or 8-pin package. The 8-pin package is called the mini-dip. The 741 can be purchased from Texas Instruments, T.I., in the mini-dip package. Usually the 14-pin DIP 709 or 741 works out very well either in a breadboard circuit or on a finished PC board layout and is recommended.

Let us now look at the general uses of the op-amp. The op-amp requires an equal positive and negative voltage supply in most applications. The amplifier has two inputs labeled – or + which are called inverting and non-inverting respectively. Either or both can be used for signal inputs. The output terminal of all economically priced op-amps is single ended. The op-amp can be a dc amplifier and can provide outputs referenced to any dc level within the dynamic range of the amplifier. The gain is controlled very accurately to a known quantity by merely choosing the ratio of two resistors. The frequency response is limited to about 1 MHz and below. The usual symbol and the terminal markings for an op-amp are shown in Fig. 2-1.

Again, if it is desired to invert a signal, connect the signal source to the minus (or inverting) terminal. This is shown in Fig. 2-2.

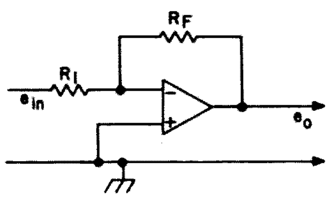


Fig. 2-2. The inverting amplifier.

By algebraic manipulation, it is possible to prove that the gain of this amplifier is the ratio of the values resistor Rf to resistor R1. The gain is independent of any amplifier characteristics as long as the open circuit amplifier gain is high. The gain equation is therefore:

Co = –Rf/R1 Cin

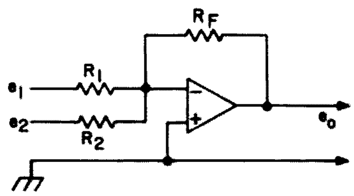


Fig. 2-3. Use of an op-amp in summing.

As was mentioned before, it is necessary to add the compensation resistor capacitor combination if a 709 is used; but if a 741 is used, no compensation is necessary.

The inverting input has other extremely interesting features. This input terminal appears to be near ground potential in its amplifying characteristics. In fact, it is called the virtual ground input. Because of this feature, this input can be used as a summing junction. Let us say that you want to add two signals and have each signal amplified by a different amount. The circuit is shown in Fig. 2-3.

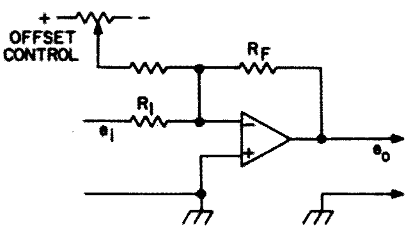


Fig. 2-4. Op-amp with offset control.

The output voltage is given by equation
Co = –CI R1/R1 –C2 Rf/R2

So far, very little has been said about dc offset. This effect is just the dc output voltage that exists when the inputs are returned to ground. This defect is caused by the IC imperfections and can be easily controlled by adding a dc signal to the input

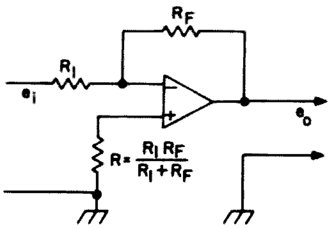


Fig. 2-5. Offset compensated op-amp.

to return the output to zero volts. As an example, see the offset control shown in Fig. 2-4. The potentiometer is adjusted so that the output is dc zero with E1 grounded. In order to balance the op-amp as much as possible, many times the need for the offset adjustment is eliminated by putting a resis-

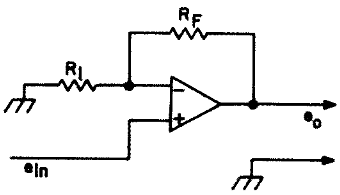


Fig. 2-6. Non-inverting op-amp.

tor from the plus (+) or non-inverting input to ground equal to the parallel combination of resistor connected to the minus (−) or inverting input terminal. This is shown in Fig. 2-5.

It is obvious that if it is desired to have the ac signal appearing at the output referenced to A plus or minus dc signal that the potentiometer shown in Fig. 2-6 can be easily adjusted to do this. The usefulness of this adjustment shows up in slow scan when accurate adjustment of the black level is necessary.

Let us look at the plus or non-inverting input. This input can be used simultaneously or alone for op-amp applications. It provides an output that is in phase with the input and

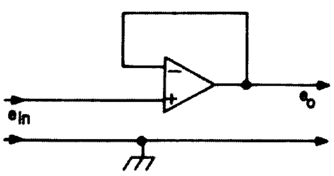


Fig. 2-7. Voltage follower op-amp.

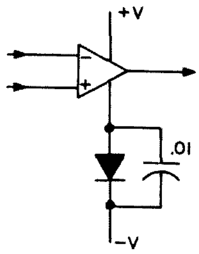


Fig. 2-8. Power lead reversal protection.

is referenced to dc similar to inputs applied to the inverting input. The circuit is shown in Fig. 2-6.

It can be shown by analysis that the gain of this configuration is given by

Co = + Cin(Rf/R1) + 1

In other words, besides the output being in phase with the input, the gain is 1 plus the gain for signals applied to the minus or inverting input. It is also possible to apply dc signals at this input to offset the output to the desired reference level.

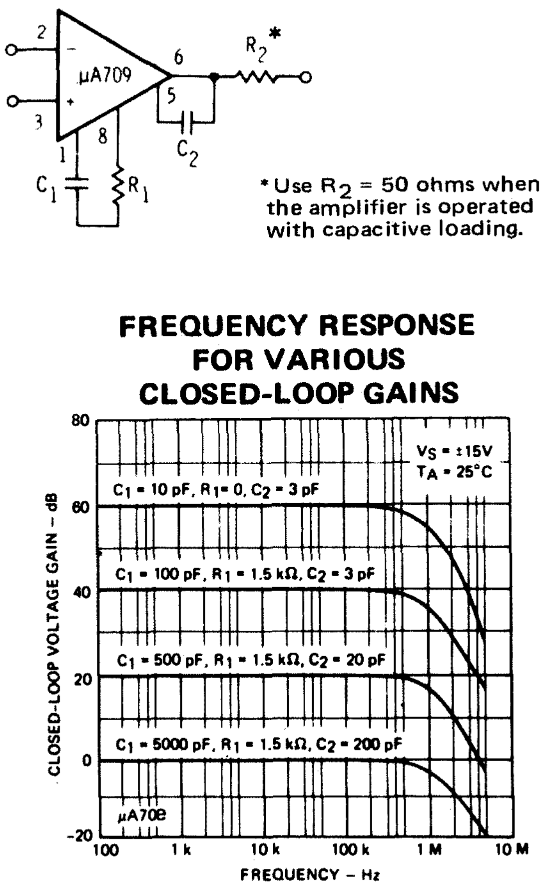
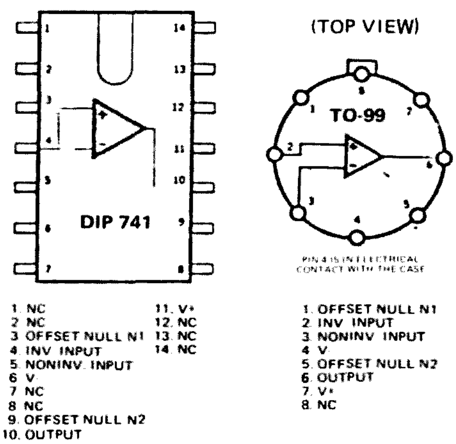


Fig. 2-9. Compensation information for the 709.

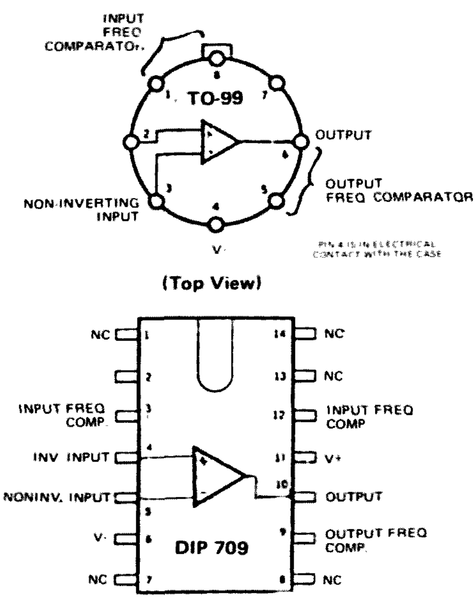
A word should be stated about the realtive size of resistors applied to the op-amp. If all resistors are kept below 1 MΩ no problems will develop. Usually the gains desired can be achieved with this range of resistors without developing any problems.

One final circuit should be shown that is needed by the slow scan active filter designer. This is the voltage follower circuit. It provides very high input impedance and low output impedance. It has a gain of +1. It is shown in Fig. 2-7.

The response of an op-amp to large changes of input signal is not as fast as might



TO-99 and DIP 741 pin connections.



TO-99 and DIP 709 pin connections.

Fig. 2-10. Note that the 741 can be used as plug-in replacement for the 709 but not vice versa.

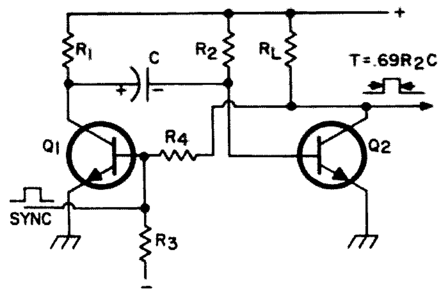


Fig. 2-11. Collector-coupled monostable multivibrator.

be expected from circuit considerations. A large change of input causes the feedback to overdrive the input stage as it attempts to correct the slow rise time of the frequency compensated stages. The clipped signal is integrated by the compensation capacitors, resulting in an output voltage that rises at a fixed rate. This rate limit, or slew rate, determines the speed with which the amplifier can respond to large signals. This slew rate becomes important in the slow scan sweep driver circuits shown later.

In order to protect an op-amp on the breadboard from accidental reversal of the power supply leads, a diode can be inserted into the negative power lead. This will assure that the reversal will not damage the internal circuitry of the op-amp. This is shown in Fig. 2-8.

For convenience to the slow scanner some of the specifications of the 709 and 741 are shown in table form below. In addition, a graph of resistor and capacitor combinations is given for the different gains for the compensated 709. The pin connections of each amplifier in its various packages are also shown in Figs. 2-9 and 2-10.

Note in Fig. 2-10 that the 741 can be used as plug-in replacement for the 709 but not vice versa.

The Monostable Multivibrator

The monostable multivibrator (or "one shot" as it is sometimes called) is used extensively in both slow scan monitors and cameras. The monostable oscillator is able to produce a pulse of the desired width from a noisy pulse recovered from the sync recovery circuits of the monitor or from the timing circuits of a camera.

The circuit of a monostable multivibrator is similar to that of other multivibrators, but differs in that it has only one stable state. The general circuit configuration of a collector-coupled monostable multivibrator is shown below in Fig. 2-11.

Since the emitter base junction of transistor Q2 is forward biased by R2, Q2 is normally in full conduction. The output voltage at the collector of Q2 is the saturation voltage of the transistor Upon the application of a positive sync pulse at the base of Q1, the collector voltage of Q1 drops and, since the voltage across a capacitor cannot change instantaneously, it causes the base of Q2 to cut off the conduction of Q2. The feedback from the collector of Q2 to the base of Q1 via R4 causes the action to be regenerative and a positive pulse occurs at the collector of Q2.

	709 Specifications	741 Specifications
Maximum power supply voltage	±22V	±22V
Minimum power supply voltage	+ 9V	± 3V
Recommended power supply voltage	±12V	±12V
Maximum differential voltage swing	±15V (Rl ⩾ 2,000Ω	±13V
dc current requirements	3 mA	3 mA
Output current	5 mA	5 mA
Slew rate	3V/μsec	0.5V/μsec

The 741 is short-circuit protected.

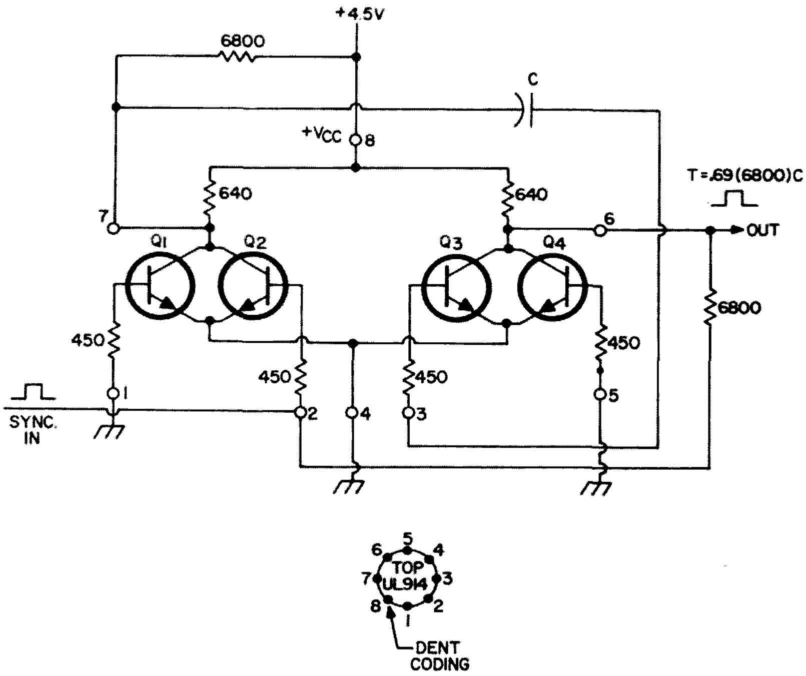


Fig. 2-12. Hookup of a UL914 as a monostable multivibrator.

The time constant of R2C determines the approximate width of the output pulse and is given by: T = 0.69R2C.

It is common practice now to utilize integrated circuits for monostable multivibrators. A popular circuit using the UL914 or MC-824F integrated circuit is shown in Fig. 2-12 Note that the 824 is a quad-transistor gate and therefore can be utilized for two monostable multivibrators.

The Schmitt Trigger Circuit

The Schmitt trigger circuit is shown in Fig. 2-13. It resembles a bistable multivibrator, but it lacks the coupling from the output collector to the input to make it have two stable states without an applied input voltage.

In order to understand the operation, assume that Q2 is conducting by virtue of its base-coupling resistor R2. The input voltage Ein is assumed to be at zero volts. As a result of the conduction of Q2, the emitter of Q1 will be raised in potential by the current flowing in Re. When the input voltage on the Base of Q1 is increased, Q1 eventually begins to conduct. Transistor Q1 will amplify this input signal which will lower the base voltage on Q2. The voltage across Re rises in response to the input voltage and together with the lower base voltage on Q2 causes Q2 to cease conduction. Under this condition, the output voltage is near the B+ voltage. The gain of the amplifier Q1 is made greater than unity so that the action happens very abruptly.

When the input voltage is lowered, it is noted that the return to the original state does not happen at the same input voltage as that required for the original transition because Q1 is cut off by the increased emitter resistor voltage across Re. This result occurs because of the non-unity gain of the amplifiers. Designers use various schemes to

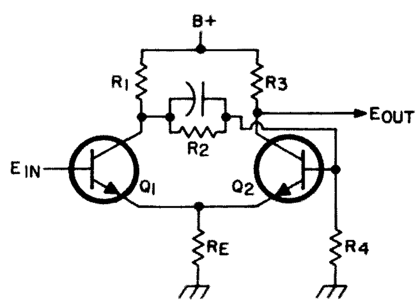


Fig. 2-13. Schmitt trigger circuit.

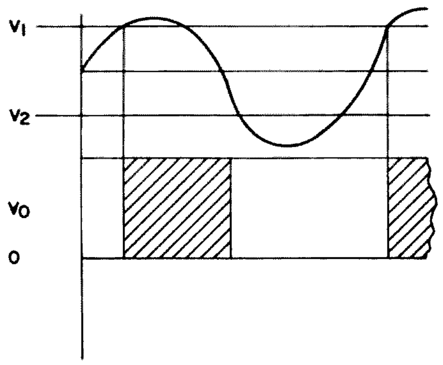


Fig. 2-14. Schmitt trigger action on an applied sine wave.

eliminate this hysteresis, but the same effect can be used to good advantage by the slow scanner.

Logic circuits used in counting usually require abrupt changes of input voltage to make the circuits trigger. If it is desired to generate a 15 Hz timing signal from a 60 Hz sine wave, it will be first necessary to distort the sine wave into a sharp-edged square wave. The desired result is shown in Fig. 2-14.

When the E input sine wave reacheds V1 the Schmitt trigger changes its state. At V2 the state changes back to the former condition. The output shows very fast transitions necessary for driving RTL logic circuits. Figure 2-15 shows a Schmitt trigger designed with an UL914 RTL gate. The unused transitors have their bases grounded to eliminate noise pickup. Sometimes a capacitor is used across the collector to base resistor to commutate or speed up the transitions. Its value is small.

Timing and Gating Circuits

The slow scanner can make use of digital technology in his design of timing circuits for cameras and monitors. This discussion will concentrate on RTL logic which stands for resistor-transistor-logic. This type of logic which is the slowest of the three main types (RTL, DTL, TTL) is also the most reasonably priced. As time passes, it is very possible that TTL (transistor-transistor-logic) will become price competitive. This type is the fastest of the economically priced logic components.

The basic element of any logic system is the gate. In RTL logic, this is the *nor* gate. It is sold by Fairchild as the UL914 or in a dual package by Motorola as the MC824. The circuit diagram of the 914 is shown in Fig. 2-16.

If the base of either transistor is raised in potential, the output drops to a near zero voltage. This positive voltage applied to the base is called a ‘high'' and the resulting output at near zero volts is called a "low." Note that the application of a high at either base causes the output to go to a low. This is called a nor gate because the output is opposite any input and the same "low" output is obtained regardless of which input is gated into a high'' condition. Note that both inputs can be in a ‘high'' condition and produce the same "low" output. The symbol for this operation is also shown in Fig. 2-16.

We are now ready to advance to an application of the *nor* gate. Often a multivibrator or switch is needed that has two stable states. A trigger pulse can be used to set the multivibrator in one condition and

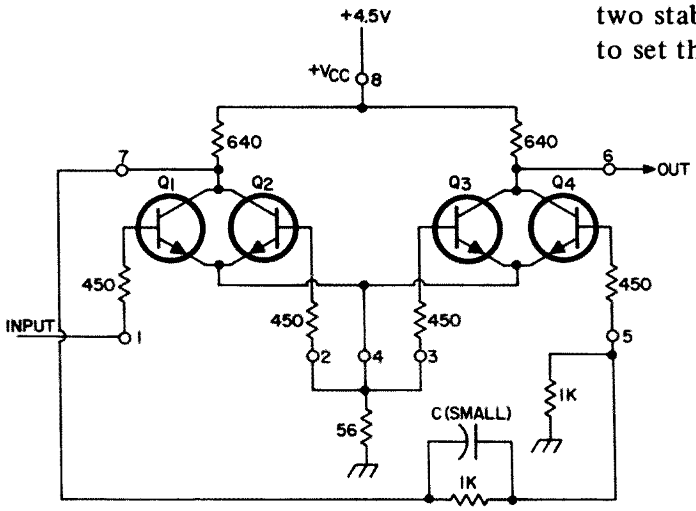


Fig. 2-15. Timing and gating circuits.

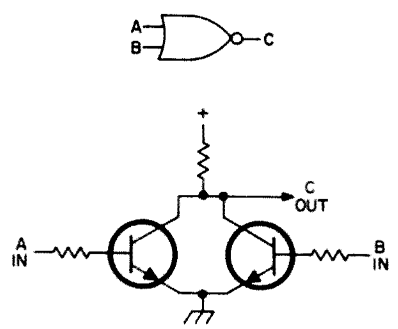


Fig. 2-16. The nor gate.

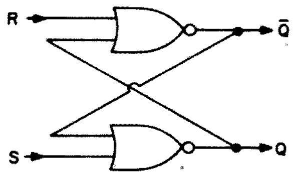


Fig. 2-17. RS flip-flop made from two nor gates.

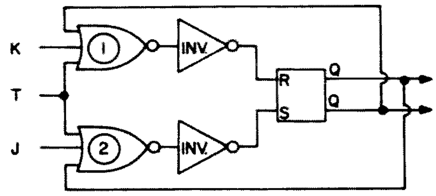


Fig. 2-18. The JK flip-flop.

a second trigger can be used to restore the multivibrator to the original condition. This principle is used in the slow scan sampling camera later described.

Connect two *nor* gates in a cross connection as shown in Fig. 2-17.

If a momentary high is put on R, Q goes low. It is assumed that S is low and output Q is high, therefore making the top gate continue to stay low even after the R high is removed. At some later time a momentary high is connected to S. This immediately causes Q to go low, forcing Q̄ high and therefore locking the bottom gate in the new condition. Inputs R and S and the outputs Q and Q are universally designated terminals of an RS flip-flop.

Let us now extend the RS flip-flop one more step to design a new kind of device called a JK flip-flop by combining several *nor* gates. The simplified circuit diagram in block form is shown in Fig. 2-18.

To start the operation assume that terminal T is grounded to a low state. A high is temporarily applied to K which causes gate 1 output to go low. This signal is passed through an inverter to make this signal a high. Q̄ goes low and does not affect flip-flop 2 so Q remains low.

Now let's assume input J is momentarily raised to a high. This input causes gate 2 output to go low. The inverter changes the signal to a high and causes the RF flip-flop to change state with Q low and Q high. The feedback from Q to K input is low, so it does not affect the operation.

The JK flip-flop has one property that makes it of particular interest to the slow scanner. This is the T (or toggle) input. If both inputs J and K are tied to ground (or "low") and a sequence of high pulses are applied to the T input, the RS flip-flop receives alternative high's on the R and S input to cause the flip-flop output to oscillate back and forth. The simple block diagram of a JK flip-flop shown in Fig. 2-18 is sensitive to pulsewidths. The more complicated correct diagram will show an additional RS flip-flop for holding purposes. The result is that for every two pulses into the T input, the Q or Q output goes through one change of state. This is a frequency divider of 2 which forms perfect square waves at the output. It will be shown later that this signal is quite useful to the slow scanner.

The JK flip-flop is commercially packaged and is sold by Fairchild as the UL923 and by Motorola in a dual package as the MC890.

What does a slow scanner do with JK flip-flops? The most obvious use is the generation of the 15 Hz line rate used in the SS camera. A typical circuit is shown in Fig. 2-19 where two "divide-by-two" JK flip-flops are hooked in cascade.

The 15 Hz square wave must now be used to trigger a monostable multivibrator to set the exact pulse length desired. The design of a monostable oscillator is covered elsewhere in this book.

What about the other frequency divisions other than two? Digital designers are very

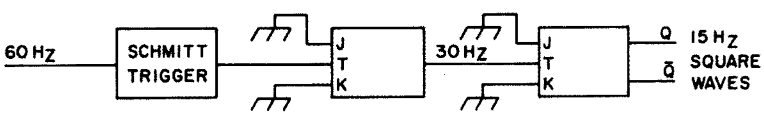


Fig. 2-19. 15 Hz timing circuit.

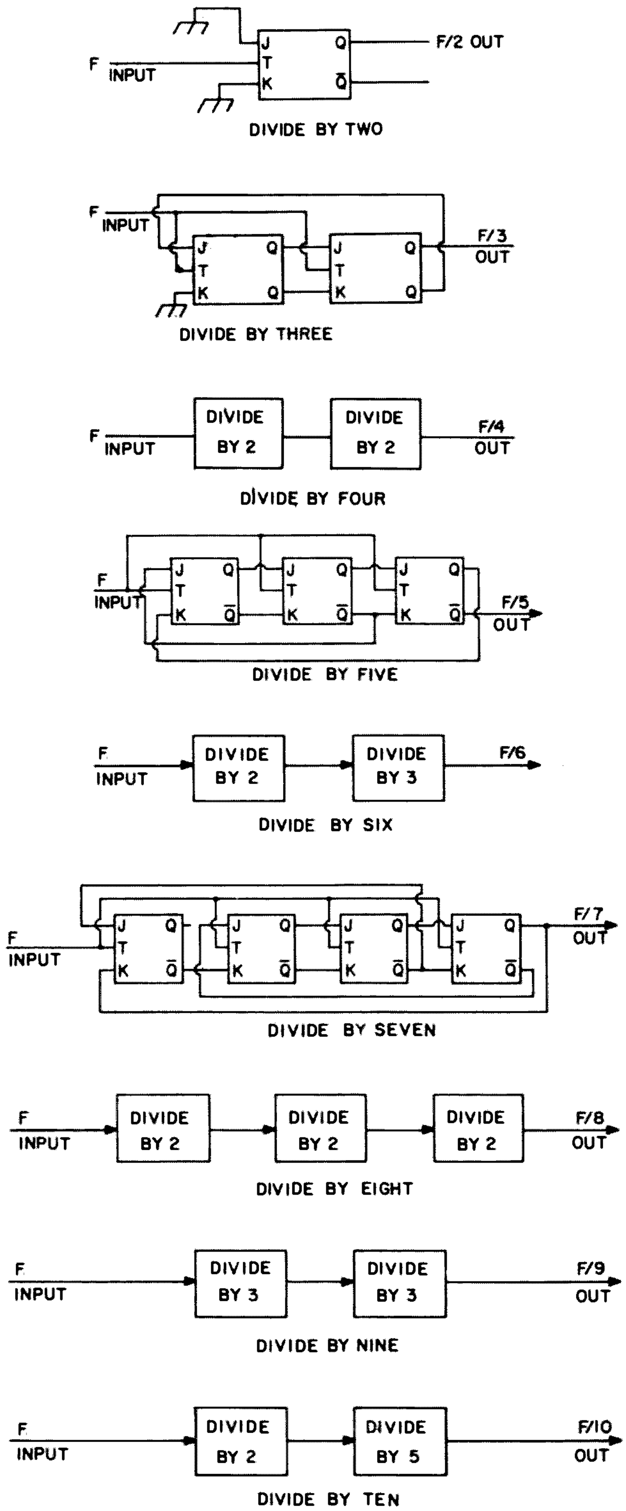

F INPUT
J T K Q Q̄
F/2 OUT
DIVIDE BY TWO
F/3 OUT
DIVIDE BY THREE
DIVIDE BY 2
F/4 OUT
DIVIDE BY FOUR
F/5 OUT
DIVIDE BY FIVE
DIVIDE BY 3
F/6
DIVIDE BY SIX
F/7 OUT
DIVIDE BY SEVEN
F/8 OUT
DIVIDE BY EIGHT
F/9 OUT
DIVIDE BY NINE
DIVIDE BY 5
F/10 OUT
DIVIDE BY TEN

Fig. 2-20.

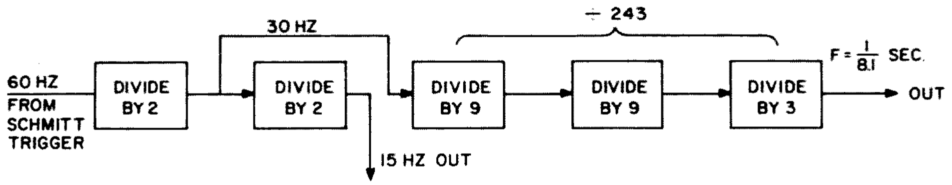


Fig. 2-21. Complete timing generator for slow scan television.

clever and have designed every modulus needed up to 10. The circuit hookups shown in Fig. 2-20 are given without derivation or proof. Those of you who are interested can trace the high's around to see the timing sets and resets to provide the indicated frequency division.

It is obvious to a digital designer that some of the divisions can be done with fewer JK flip-flops, but cascading is simpler to the novice.

Finally a block diagram is shown in Fig. 2-21 that produces all the basic timing needed in a slow scan camera. The outputs of 15 Hz and eight seconds are derived for the 60 Hz mains. Later on a more sophisticated timing generator is shown that provides for different scan rates and complete locking of the sampling camera raster to the 60 Hz mains.

The hookup diagram of the UL923 JK flip-flop and the dual MC890P is shown below in Fig. 2-22. We wish to thank W9ZRX for help with logic ideas shown here.

Phase Lock Loops

An extremely versatile phase lock loop integrated circuit has recently been developed by the Signetics Corp. Other companies are now producing this type of circuit, but the original package known as the SE565 and NE565 are the most popular and economically priced.

The block diagram of the phase lock loop is illustrated in Fig. 2-23.

The basic parts of the package include a phase detector, amplifier, loop filter, and a voltage-controlled oscillator (VCO). The versatility of this package comes from the fact that each part of the loop can be externally connected to other circuits and their outputs reintroduced back into the loop.

Some of the slow scan applications of the phase lock loop are as follows:

1. Horizontal sync detector in the slow scan monitor.
2. Voltage-controlled oscillator FM generator in the SS camera.
3. Line locked frequency divider in the SS camera.

There are countless other applications of the PLL in other phases of amateur radio. A few of the obvious applications are the RTTY converter, synchronous AM detector, and FM detector. These applications have been well covered in many of the popular amateur radio magazines. The Signetics application notes also carry many interesting applications.

The phase lock loop acts like a very narrow filter. A phase comparison is made between the incoming signal frequency and the frequency of a voltage-controlled oscillator which has been adjusted to operate very close to the frequency being detected. A phase error results in a positive or negative voltage which is filtered by an RC time

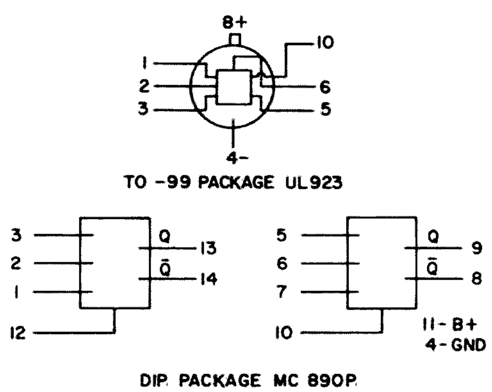


Fig. 2-22. Connections to popular RTL JK flip-flops.

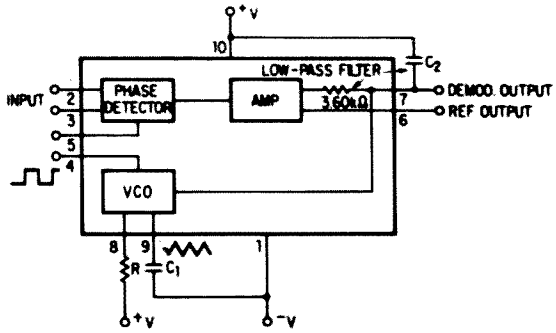


Fig. 2-23. The phase lock loop.

constant and is used to drive the VCO closer to the incoming frequency until both are locked together. The secret of the PLL comes from its ability to average several cycles of the incoming frequency to produce a VCO frequency that does not show the short time noise variations of the incoming frequency. This averaging results from having a long loop time constant.

The net result is that the phase lock loop is free running and locks on to a very noisy input signal and has a highly filtered output averaged signal. As an example, if the slow scanner is interested in detecting a 15 Hz horizontal slow scan sync signal, the VCO capacitor is calculated by formula to give a VCO frequency of 15 Hz. The loop capacitor is designed to have a time constant that is 15 to 20 times the period of the 15 Hz input horizontal pulse. The output VCO 15 Hz signal will not be locked to the average period of the 15 or 20 incoming 15 Hz pulses. This circuit is extremely sophisticated inside the integrated circuit package, but it is simple to design and represents an excellent way to recover sync for the slow scanner monitor.

The design formulas for the loop are as follows:

$$f_o = \frac{1}{4R_1C_1}, \text{ let } R_1 = 4000$$

$$C_1 = \frac{1}{4R_1 f_o} = \frac{1}{4(4000)(15)} = 4\ \mu F$$

$$T = 3.6 \times 10^3 C_2 = 15\ \left(\frac{1}{15\ Hz}\right)$$

$$C_2 = 277\ \mu F$$

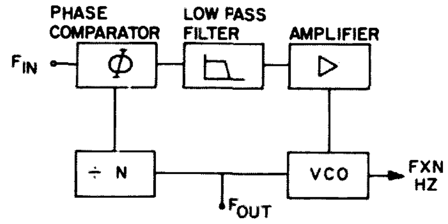


Fig. 2-24. High frequency phase locking.

Another application of the PLL is in the generation of the FM video in the SS camera. Here the PLL-VCO is changed in its frequency output by the incoming base band video. Only the VCO part of the PLL package is used here. The formula for calculation of CI is the same as before. The design should result in a frequency near the 1200 to 2300 Hz FM band of interest. The actual design of this VCO circuit is given in a later discussion of the integrated circuit SS sampling camera. Recently Signetics announced an integrated circuit VCO that is essentially the VCO used in the NE-565 PLL. This new IC VCO is called an SE/NE-566.

Last but not least is another extremely interesting application of the PLL. If it is desired to synchronize a high frequency, i.e., 4800 Hz, with a local standard 60 Hz, the PLL can utilize countdown circuits and generate a host of locked sync signals. As an example, consider Fig. 2-24.

The digital divider circuits shown in the previous discussion of RTL frequency division can be used here to give the desired division. This is an excellent way to lock the sampling camera horizontal sweep frequency to the 60 Hz mains. This complete circuit is shown later in the integrated circuit SS sampling camera design.

This discussion is far too brief to do justice to the PLL circuit. Many more applications of this integrated circuit will be discovered by the slow scanner. It is extremely easy to use in all synchronous generation and detection applications.

The connections and terminals of the SE/NE565 are shown in Fig. 2-25.

Sweep Generation

Most monitors and cameras used for slow scan television use a driven sweep circuit to generate the sawtooth voltage or current to produce the raster.

Driven sweep circuits require sync pulse repetition to cycle the sawtooth in contrast to free running sweep generators which require synchronization from a pulse chain. The result on the CRO face is a completely black tube face for driven sweeps without sync pulses and a constantly recurring raster for synchronized sweeps even in the absence of sync pulses. Today it is a matter of opinion which is best, but in the early days of slow scan TV (late 1950's) the drift and synchronizing difficulty of free running sweep circuits resulted in the use of driven sweeps. Today, the free running unijunction oscillators and phase lock loop circuits can produce some very good results with synchronization.

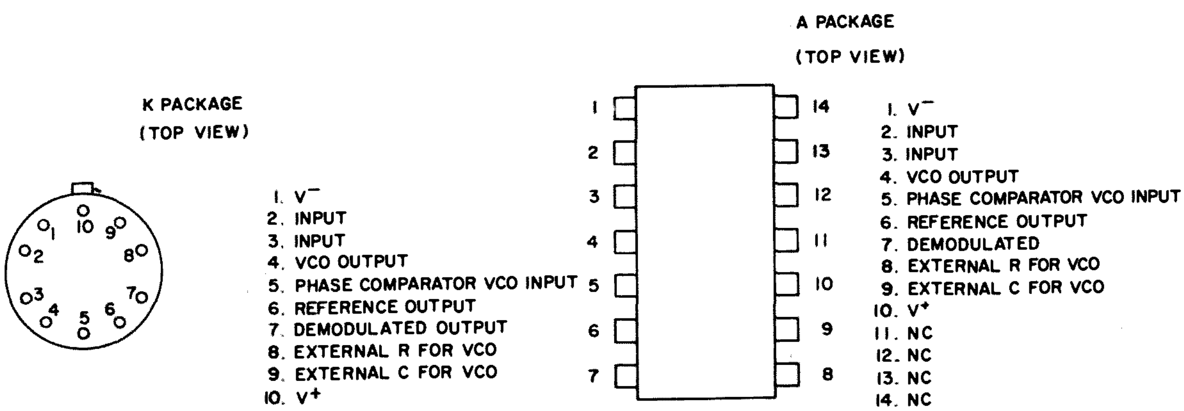


Fig. 2-25. Connections to the SE/NE 565 PLL.

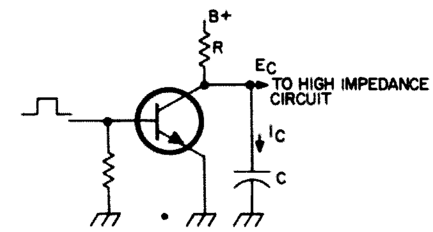


Fig. 2-26. Capacitor discharge circuit.

Sweep circuits all have some kind of a capacitor circuit that is charged at a more or less constant current. The simple circuit in Fig. 2-26 shows the principle.

Without the presence of the sync pulse, the transistor is in a non-conductive state. Capacitor "C" is charged from the positive supply voltage through resistor R. The charge of voltage across a capacitor is given by $\Delta E/\Delta T = i_C/C$.

We know that a sawtooth voltage means equal changes of voltage with equal changes of time. Therefore, i_C/C must remain constant throughout the sawtooth. It is obvious that Ic will not remain constant in the above circuit because as the capacitor builds up in voltage, it opposes the flow of current from B+ through R to the capacitor. This decrease of current has a name "exponential" in contrast to the "linear" change desired. There are several ways devised by circuit designers to minimize this deviation from a linear ramp or sawtooth voltage. The easiest way is to utilize only a small fraction of the total Ec variation. This is shown in Fig. 2-27.

If the ramp is restricted from building up to B+, the output voltage will be approximately linear. The circuit values must be adjusted to give the desired output voltage and linearity desired for the repetition rate of the pulses that are applied to the base of the transistor. At every pulse time, the transistor is turned on and the capacitor is discharged to near zero voltage and the cycle

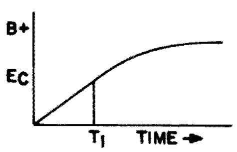


Fig. 2-27. Simple RC ramp generation.

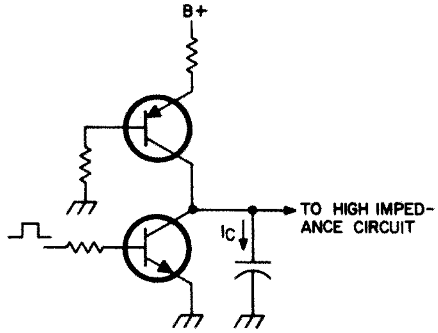


Fig. 2-28. Current source sweep.

then repeats itself. This pulse width must be sufficiently wide to discharge the capacitor through the resistance of the transistor. Some care must be taken to make sure that the transistor does not burn out from the high discharge currents of the capacitor.

A better solution to linearity is to use a current source instead of a resistor to supply the current to the capacitor. A current source can be a current from a source of high voltage and high value resistor. The current being supplied should not be affected by the building up of the capacitor voltage. Rather than use a high voltage and resistor combination, active components such as pentodes or transistors can be used for the current source. These devices are distinguished by having "flat" current versus voltage characteristics. The output voltage of the capacitor will be a linear ramp as long as the current source remains constant. Such a circuit is shown in Fig. 2-28.

In the circuits previously reviewed, there still remains a problem of interfacing the high impedance capacitor circuit with the outside world. Circuit designers many times use what is called a "Darlington" pair to interface with the sweep driver stage. A Darlington pair is shown in Fig. 2-29.

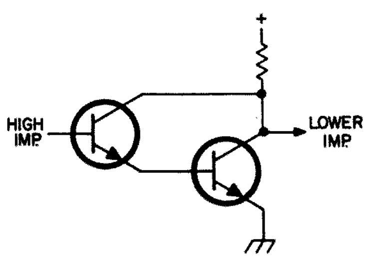


Fig. 2-29. Darlington pair.

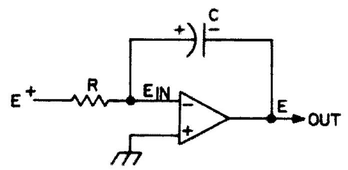


Fig. 2-30. Operational amplifier with RC integrator.

Very good sweep generators can be designed today from operational amplifiers. These small amplifiers have very high gain, low drift, and are very low priced. The famous 709 and compensated 741 are amplifiers made by many integrated circuit companies today. These op-amps come in three basic packages – flat pack, DIP, and TO-99. The DIP or dual in-line package and TO-99 are the most attractive from a ham viewpoint. The flat pack is cheaper but difficult to mount in breadboard circuits.

The op-amp is shown in Fig. 2-30 with a capacitor and resistor.

Remember that the amplifier has very high gain, i.e., 100,000. This means at the minus or inverting input of the op-amp that the input voltage is very low for full output. Since the charging circuits can be calculated as $I = (E+ - Ein)/R$ and Ein is very low over the full cycle, the charging current is constant and very nearly equal to $I = E+/R$. The current flowing into the amplifier is very low due to Ein being low and also to the high input impedance of the amplifier. This means that the capacitor receives nearly all of the current through resistor R and the output voltage of the amplifier linearly decreases to the limit of saturation. It is easy to visualize this operation if it is remembered that the plus end of the capacitor is at near ground voltage, therefore the capacitor can be redrawn as going directly across the output to ground. This effect has a name and is called "virtual ground" input. If you doubt this sequence of events, check them with a good grade oscilloscope.

This circuit still must be made to recycle itself so some way must be provided to discharge the capacitor once it has charged up.

Two ways are used to cycle the capacitor. Either way shorts the capacitor by means of an electronic switch. A bipolar transistor (ordinary transistor) can be used, but a much more effective switch is the field effect transistor (FET). The circuit is shown in Fig. 2-31.

Upon the application of the pulse at the sync repetition rate, the FET shorts the capacitor and causes the cycle to repeat.

Another way to generate a sweep is to use a synchronized free running oscillator. There are many ways to design a free running sweep circuit that can be synchronized by the detected transmitted sync pulses. The stability of any sweep generator is basically related to the sharpness and quality of the synchronizing pulse. The ordinary home TV set is an example of a synchronized free running sweep or raster. In the early days of commercial TV, sets different in the quality of sync recovery and their operation became a measure of excellence when considering the purchase of a receiver. All free running sweep circuits must have an oscillator that repeats or cycles near the desired frequency of the sweep. In addition there must be another circuit that sets the exact retrace time and forms the desired blanking and sync pulses if desired. The proper width pulse can now be used to discharge a capacitor in any of the ways discussed in the section on driven sweeps.

Examples of free running sweep generator can be a blocking oscillator, multivibrator, unijunction oscillator, or a VCO in commercially available phase lock loop IC packages. The pulse width shaper can be a monstable multivibrator or a silicon controlled rectifier discharge circuit.

All of the above circuits can be made to work very well and the choice of one or the

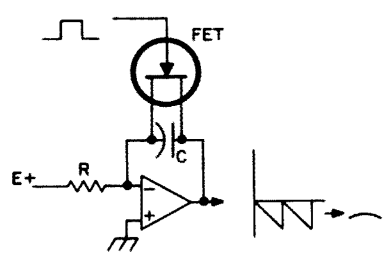


Fig. 2-31. Op-amp sweep circuit with FET switch.

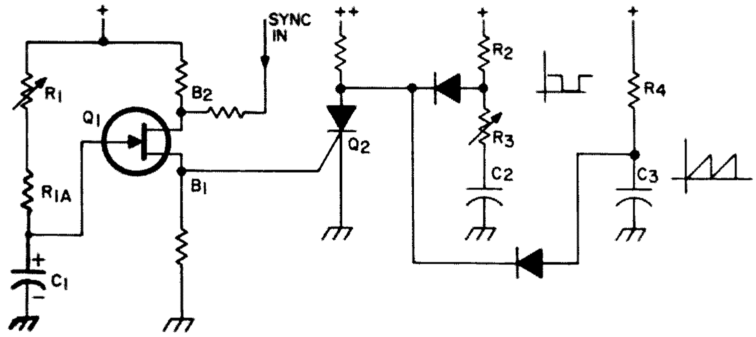


Fig. 2-32. Unijunction sweep generator.

other may depend upon the ease of synchronizing the free running oscillator, temperature consideration, or one of economics and availability.

As an example consider a simple unijunction relaxation oscillator. The basic circuit is shown in Fig. 2-32.

Capacitor C1 charges through R1 and R1A until the breakdown of the emitter of Q1 occurs causing the discharge of C1 through the emitter-base 1 junction of Q1. Once this occurs, the potential of C1 drops and eventually the conduction stops and the cycle repeats. Sync pulses are added in at base 2 in order to cause the discharge to occur a fraction of time before the normal discharge cycling.

The output of the unijunction transistor is connected to the base of a silicon controlled rectifier (SCR). This pulse causes the SCR to discharge for a period of time determined by the charge stored in C2 and the discharge time constant. This is adjusted to give the required pulse width.

This pulse is used to discharge a capacitor C3 as discussed earlier to create a sawtooth or ramp voltage.

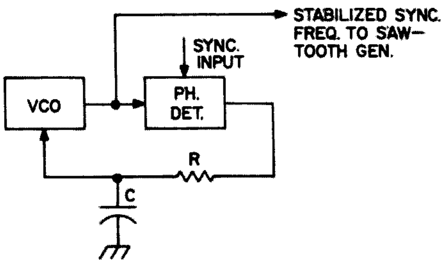


Fig. 2-33. Phase lock loop.

A very interesting method of creating a free running raster is the use of a phase lock loop. The basic circuit is shown in Fig. 2-33.

The VCO is a stable oscillator whose frequency can be controlled by means of a dc input voltage. The phase detector is able to compare in phase two signals that are the same frequency but differ in phase. The output of the phase detector is a noisy dc signal that is filtered by an RC time constant in the loop. This time constant is made long enough so the loop exceeds the repetition rate of the sync pulses by 10–25 times. The result is that the loop acts like a very narrow filter and develops a stable signal based on the average of many receiver sync pulses. When no signals are being received, the raster continues to sweep at a frequency very near the sync repetition rate.

Driven sweep oscillators can effectively utilize some kind of lock out monostable oscillator to prevent the main monostable from triggering falsely on noise spikes after the main monostable has recovered. The synchronized free running oscillators have some basic immunity to noise since they can only be synchronized near the normal repetition rate.

This discussion of popular slow scan television circuits will be continued next month. Among the topics to be described are sweep drivers, subcarrier generators, limiters and discriminators. The design of active filters for slow scan use will also be covered and a complete regulated power supply that is suitable for solid state slow scan circuitry will be presented.

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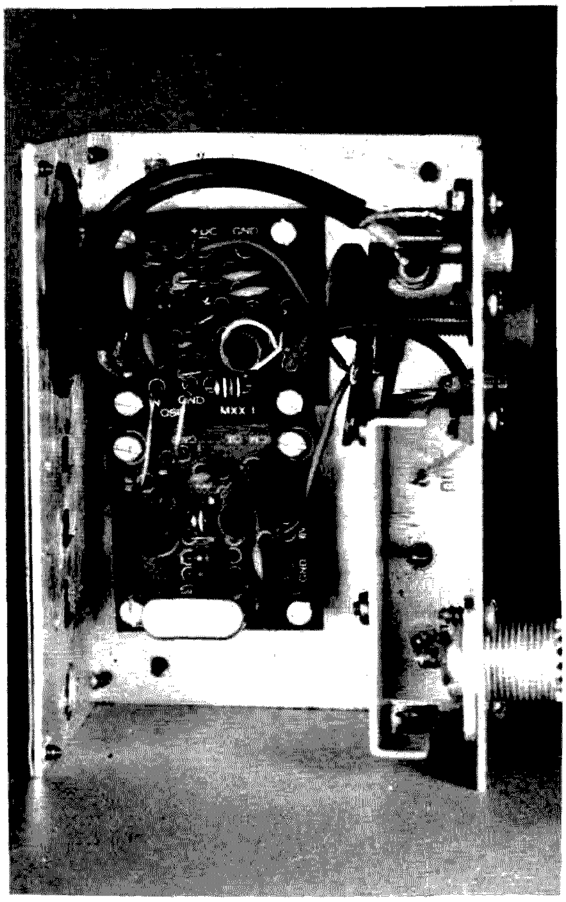

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A 2-METER CONVERTER FOR AN AM-FM BROADCAST RECEIVER

Many articles in the past have been written on converters. But this one is different in that it is designed to use an FM broadcast receiver as the tuneable i-f and preassembled modules as much as possible.

Most two meter converters have had their output on either 10 or 20 meters. For the beginner, this alone could be a drawback in that he may not have a general coverage receiver. This project uses an ordinary FM broadcast band tuner or receiver. Using the tuner has several marked advantages over the conventional AM/SSB receiver. First, since it's FM to begin with, you'll get the added quieting and noise suppression that's lost in an AM/SSB receiver. Second, depending on the complexity of the tuner, it may have muting and afc provisions. The muting can be used as a squelch and the afc keeps those off-frequency stations on your dial without retuning. Third, maybe you're a newcomer to the two meter band and don't know the more popular frequencies that are in use in your area. With this converter you can cover the entire two meter band, MARS frequencies and some of the commercial band from 144 to 164 MHz.

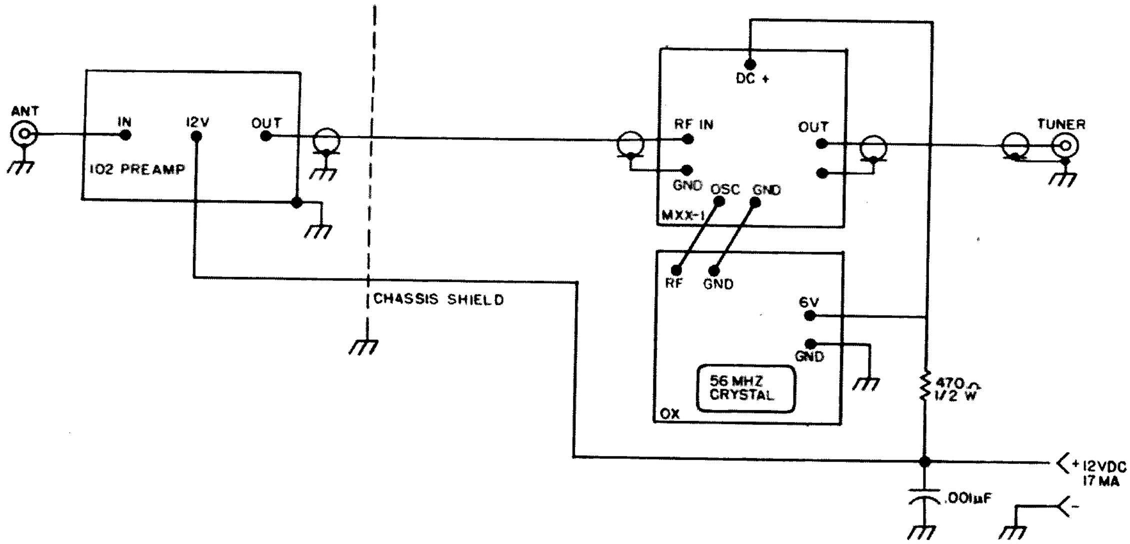

Fig. 1. Block diagram of the converter showing the method of connecting the modules.

As was mentioned, modules are used to their fullest extent to simplify construction and to eliminate those hard-to-find parts. The unit is designed into three subassemblies which are placed on a small chassis. An rf amp, mixer and oscillator make up the three modules. The rf amplifier used is manufactured by Vanguard Labs (196–23 Jamaica Ave., Hollis NY 11423). Their 102 preamp has less than a 2 dB noise figure with a power gain of 24 dB at 150 MHz. The preamp comes from the factory tuned to the frequency of your choice with a bandwidth of 2–4 MHz. This particular model uses a neutralized J-FET. From the preamp, the signal is passed to a mixer stage where a 56 MHz signal is injected from the local oscillator. After converting the signal down to the 88–108 MHz band, the signal appears at the tuner output jack. For example, if the input signal is at 144 MHz, then the converter's output will be 88 MHz. The lower part of the FM dial was chosen because of the general lack of stations there. The stations that are present are mostly lower power and educational.

The mixer and oscillator kits are from International Crystal (10 North Lee, Oklahoma City OK 73102). The MXX-1 and OX are the mixer and oscillator kits respectively. Both are the HI kits with a 56.0 MHz EX crystal used in the oscillator.

Construction is simple, straightforward and noncritical. The case used is a small cowl minibox which measured 5 x 10 x 7.5 cm. A shield is mounted across the preamp chassis to suppress any unwanted FM broadcast signals. The modules layout is not particularly critical, although the relative positions should be followed for best results. A SO-239 is used for the antenna input, and a phono connector is used for the converter's output. See the photograph for details.

The kits are easy to assemble and go together without any problems. Entire construction time for the OX and MXX-1 take about thirty-five minutes. On the OX board use the coil with the red dot. The MXX-1 coil and capacitor are the coil with the green dot and the 4.7 pF capacitor. After completing the boards, double check your wiring, especially transistor placement. Make

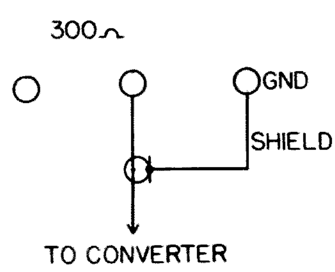

Fig. 2. To use coax with a 300Ω input, connect the shield to chassis ground and the center conductor to one of the 300Ω inputs.

sure you have soldered the terminals that are factory staked into the boards. The oscillator and mixer operate on 6V dc. A quick check of oscillator output can be performed by using a field strength meter or by measuring current flow in the collector.

Next mount the boards and preamp using the screws and stand-offs supplied. Connect the antenna to the preamp input. If the distance is over 2 cm use shielded cable. Now connect the oscillator rf output to the mixer's OSC input with a short piece of wire. The mixer output uses RG-58 which goes to the TUNER jack. Preamp "OUT" to "rf" mixer input uses miniature coax cable. The only thing left is for power, which is primarily 12V dc for the preamp and 6V for the mixer and oscillator. The preamp is connected directly to the 12V source while the mixer and oscillator receive their power through a 470Ω resistor.

After all connections are made connect an antenna. Use coax for the converter's output to the tuner.

With a signal present on the tuner, adjust the mixer coil for maximum signal. If the tuner is not equipped with a meter, adjust for maximum quieting. Since the output is untuned, some TV stations may be heard along with the normal two meter activity. This can be eliminated by using an 88–108 MHz bandpass filter. These are available through most parts jobbers. Here in the Los Angeles area, channel 11 is weakly heard around 92 MHz on the FM dial.

Oscillator stability is quite good. A ¼λ whip brings in most of the stations that my commercial unit receives. Coverage of MARS and the commercial band are an added benefit. Mobile telephone, fire and police departments, and the government weather broadcasts, are all received with full quieting signal levels.

The only problem you may encounter is low sensitivity. This happens on some of the older tuners. If your tuner has an input sensitivity of around 2 μV, no added amplification should be necessary. If not, adding another International crystal module, the SAX-1 rf amplifier, between the converter and tuner, should bring the sensitivity up to a respectable level.

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ALL PURPOSE METERING CIRCUIT

The builder of more complex equipment is often faced with a choice of three evils, whether to meter all circuits which should be metered with individual meters, with a single switched meter or forget the whole thing and trust the equipment to perform in a satisfactory manner after initial adjustment. Individual metering is rather expensive and space-consuming and must in most instances be confined to "price is no object" projects. Obviously, lack of metering is an invitation to trouble, expense, and work, repairing and replacing ruined components. Switched metering too has its shortcomings, but when used in conjunction with full-time metering of the most important circuits it serves well.

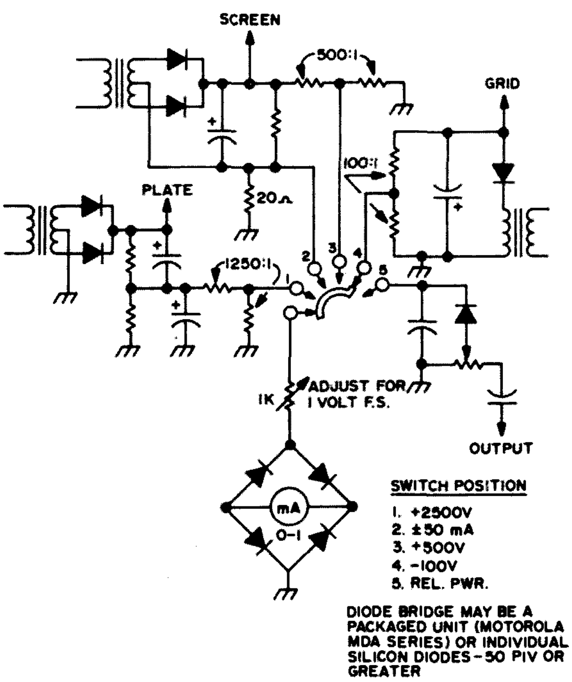

Fig. 1. Diode bridge may be a packaged unit (Motorola MDS series) or individual silicon diodes of >50 PIV.

As a typical example, a linear amplifier might well have a plate current meter plus a second switchable meter which could be used to monitor filament, screen, plate, and bias voltage, screen current, relative power or any desired combination. It will be noted that these voltages and currents are of various polarities and magnitudes and may (as in tetrode screen current) be both positive and negative depending upon operating conditions. It would not be easy to design a conventional switching circuit capable of measuring all these parameters.

The easiest method of attacking this problem is to install the meter in a diode bridge in such a way as to cause an upscale deflection no matter which polarity is applied. By proper selection of component values it is possible to use the basic meter scale times a factor for each function. By this I mean the meter/bridge assembly is made to read a set value (one volt is handy) and all inputs to the switch are arranged to produce this voltage under full scale conditions of the range desired. In the example, this system is used in conjunction with a 0–1 mA meter movement to read ± 50 mA screen current, + 500V screen voltage, + 2500 high voltage, and –100V bias, not to mention relative power. The switch is a simple single pole, five-position type. In your design let Ohms Law be your guide and be sure to use a voltage divider where required to keep surges out of the meter. Remember too to use a non-shorting switch to prevent connecting adjacent circuitry together while switching.

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ARE FET'S REALLY BIASED?

The field effect transistor, or FET as it is called, has proven to be a very unique device and is now being used quite widely in the electronic industry as well as in amateur radio projects.

The low cost FET is popular with hams because so many things can be done with this electronic marvel. The junction type of FET is extremely rugged, but a few basic facts on these devices should be taken into consideration before your next project with the FET is started. The following points are generally ignored, and as a result many projects do not work out-right, if at all, even though you have followed the schematic and used the same parts. In some cases, the FET has been shunned because it was thought not to be as stable as the transistor. Let s take a look at the important points and how to use them so we can make the FET circuit just as stable, if not more so, as the transistor or the tube.

One of the most important and overlooked parameters of the FET is the I_{DSS} or zero bias drain current of the device. This is always found on the FET spec sheet and is a range of current from 1 mA to as much as 50 mA. Different FET's will have different ranges of current. If one person uses a FET with an I_{DSS} of 2 mA and you use a FET of the same number with an I_{DSS} of 10 mA, you may not be able to get your project to work right, and you will find that the slightest temperature variation will change the circuit conditions. To find out why, let's look at the curve of the drain current of a FET under different temperature conditions to see how they vary. Figure 1 shows this curve with the drain current plotted against

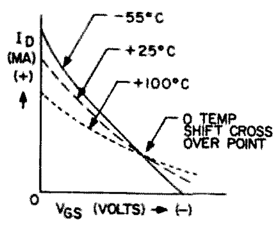

Fig. 1. Id versus Vgs for 0 temperature shift bias point.

the gate voltage. As you can see, when the temperature is the coldest, the drain current is the highest at zero bias, and when the temperature goes up, the maximum drain current decreases.

If the FET were biased at zero bias, the maximum amount of gain can be obtained from the circuit, but with the maximum sensitivity to temperature change. The three curves cross at a point with the gate bias negative, causing a low flow of drain current. Beyond that point, the action changes. When designing a circuit for maximum stability, such as an amplifier for mobile operation or an oscillator for a vfo, we would like to bias the FET at the cross-over point or the zero temperature point. This would result in the smallest change in drain current for the maximum temperature variation. To achieve this, you could run a set of curves on the FET's that you are using to find this point, but there is a much simpler method.

Most FET manufacturers have found that the zero temperature point is around .9 to .11 of the I_{DSS} of the FET. We can use this handy information to design our circuits for maximum stability and minimum drift. All we must do is measure the zero bias drain of the FET that we are going to use, and use the average of .10 times the zero bias drain current to find the operating point of the transistor. The I_{DSS} of the FET can be found in two ways: with a commercial FET tester such as the Sencore TF151 that will measure this drain current as well as the Gm or with the circuit of Fig. 2.

The circuit is set up to measure the zero bias drain current for an "N" channel FET. To measure the zero bias drain current of a "P" channel, reverse the meter and battery connections shown. The battery voltage is not critical and any value between six and nine volts can be used with the same figures resulting.

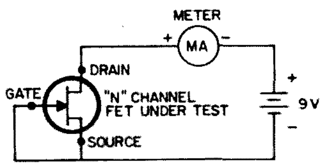

Fig. 2. Setup for measuring I_{DSS} of a FET reverse meter and battery for "P" channel FET.

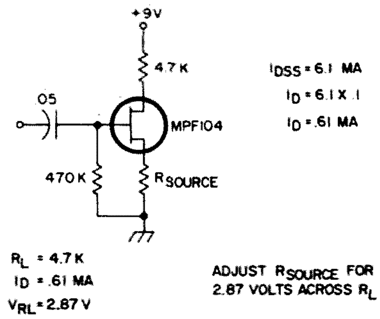

Fig. 3. Setting up bias point on a FET for 0 temperature shift.

Here are a few examples of different I_{DSS} currents I measured on several Motorola MPF104 junction FET's. If a pair of FET's were needed, such as in a bridge circuit, numbers 2 and 3 would be the best suited as they are the closest in zero bias drain current measurements.

FET	I_{DSS}
1	4.3 mA
2	6.1 mA
3	6.9 mA
4	7.5 mA

Numbers 3 and 4 could also be used as a matched pair, but number 1 could not be used with the other three as a matched pair such as in a bridge circuit for a voltmeter. If number 1 was matched with any of the other FET's, the circuit would be unstable and subject to temperature drift. Any of the FET's above could be used as an amplifier for a zero bias stable condition. Let's use the FET with the zero bias drain current of 6.1 mA as an example of how we find the proper operating point of the FET that we are going to use.

The example uses a load resistor of 4.7K and is being used as a low level audio amplifier for a mike stage. If the zero bias drain current is 6.1 mA, then we can use the average of the .08 to .11 figure which is normally .10 as a starting point. Multiply the figure of 6.1 mA times .10 which gives us a figure of .61 mA of drain current for the FET. Using Ohm's Law, this would give us a voltage drop of .61 mA times 4.7K or 2.87V across the load resistor. To achieve this voltage drop, we must now adjust the source

resistor in the circuit until the voltage drop across the load resistor is 2.87V. If you have the curves for the FET this can be done simply by finding out how much bias is needed to limit the drain current to around this figure and, again using Ohm's Law, figure out a source resistor with the drain current of .61 mA and the bias voltage. In most cases it is much easier to use a resistor substitution box or a pot in the source and adjust the value until you find the voltage at the drain load resistor to be that which you have calculated.

If a low level signal is to be amplified, a FET with a low I_{DSS} can be used, but if a high level of signal is to be amplified, it is much better to use a FET with a high I_{DSS} so that the resulting drain current will allow a greater swing and still remain in the linear portion of the curve, as you would for a tube circuit. Above all, do not allow the FET to run at a drain current above its normal I_{DSS} or permanent damage to the transistor will result. If you are replacing a FET in an existing circuit, be sure to check to see how much drain current was being drawn by the previous FET. If the circuit draws more drain current than the maximum I_{DSS} of the replacement FET, you will have trouble.

The zero bias drain current or I_{DSS} can be helpful in many ways; for example, to find the best operating point for a vfo, matching a pair of FET's for a bridge circuit, or finding the best operating point for an amplifier for best stability. In rf applications the FET is ideal and in most cases is biased at zero bias to get the maximum gain from the circuit with an agc voltage to control the signal level from the stage. In a cascade amplifier the upper FET must have an I_{DSS} of two to four times that of lower FET.

The FET is the ideal device to be used in rf amplifiers, vfo's, i-f circuits, audio stages, and many others. The high input impeuance that can be achieved with the FET also makes it the ideal device to be used in test equipment around the shack. By using Ohm's Law and the zero bias drain current or I_{DSS} of the FET, these circuits can be made to perform with great satisfiaction and very little trouble.

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FREQUENCY COUNTER INPUT CIRCUIT

Having read with interest all the articles in *73* and elsewhere on digital frequency counters, the bug finally got me about three years ago, and I started to build my own. It was a while before the finished product finally emerged but I was happy with the result, learned a tremendous amount in the process, and couldn't live without a "counter' any longer.

The purpose of this article is to give the solution to a problem I have always had with the counter as originally built. Input impedance was only 10k which made it a bit low and caused an upset to signal generator output and other circuits when the counter was connected to them. Related to input was also the amount of signal required to drive the counter and in a secondary way the problem of always having to set the input level.

I have tried several solutions to the problem but did not really get on the right track until I read the "Digital Instruments" article by Donald L. Steinbach in *Electronics World* January 1971. Mr. Steinbach used a differential voltage comparator as a Schmitt trigger driven by a FET.

The result of my experiments with this circuit are shown in Fig. 1. There is no input level control in this circuit. The sensitivity is 10 dB better than the original circuit using a pair of inverters as a shaping circuit. The input is protected from high level input signals and the input impedance is much higher than the original

The absence of an input level control is attributed to the components associated with the gate circuit of Q1. Resistor R1 and capacitor C1 couple the input signal to the gate of Q1. An input signal of approximately 32 mV is all that is required to drive the trigger circuit in a stable condition all the way up to 10 MHz. If the input signal becomes greater than 2 volts p-p the diodes, D1 and D2, will conduct and clip the input at this level. This protects the gate of the FET, Q1, and also eliminates the need for an input level control.

The IC is a Differential Voltage Comparator. I used one of the '3 for a dollar' Poly Pak 710's. This unit is a 10 lead flat pack so not as easy to work with as the TO-99, but in the end makes a very neat circuit. Figure 2 gives the outline details of the 710 flat pack

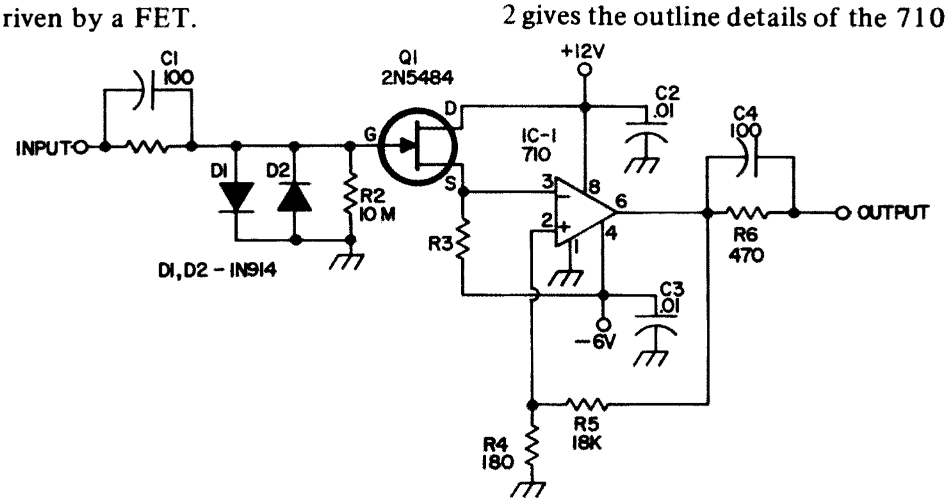

Fig. 1. Diagram of counter input circuit. The value of the resistor in parallel with C, at the input, is 100K. The value of R_3 equals 1.8K.

and also of the MC170CG which is in a TO-99 package Either will work well in this circuit and specifications are given for both units for reference purposes.

IC-1 is hooked up as a Schmitt trigger. When the voltage on the source of the FET, Q1, reaches the upper trip point of about 7 mV the Schmitt trigger will latch on. The output will be driven negative very quickly by the feedback action to the non-inverting input (marked +).

The way this works is as follows, for those of us who are new at these things. The positive going input signal is applied to the "Inverting" (–) input. That is to say, the positive going signal will be amplified and inverted, thus becoming a negative going signal at the output. This 'Non-inverting' (+) input will amplify whatever signal is applied to it and be in the same phase at the output. Since this is the feedback point in our circuit the original input signal, inverted, is fed to this non-inverting input, amplified and comes from the output even more negative. The result is a very fast switching action and a beautiful square wave, as the IC is driven into saturation in each direction, to apply to our counter circuits.

The reverse action is true also. As the input swings in the negative direction the output will switch into the positive direction. The voltage required to overcome the action in one direction and reverse it into the opposite direction is the hysteresis voltage and determines the minimum signal at the source of the FET which will trigger the IC. The hysteresis voltage in this circuit is about 20 to 30 mV.There are two cautions to take into consideration when building the circuit. One is that the bypass capacitors C2 and C3 should be mounted as close to the IC

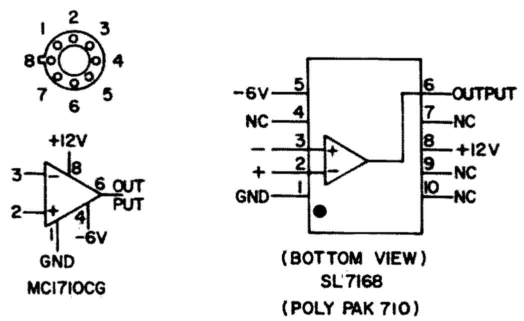

Fig 2. Base diagrams.

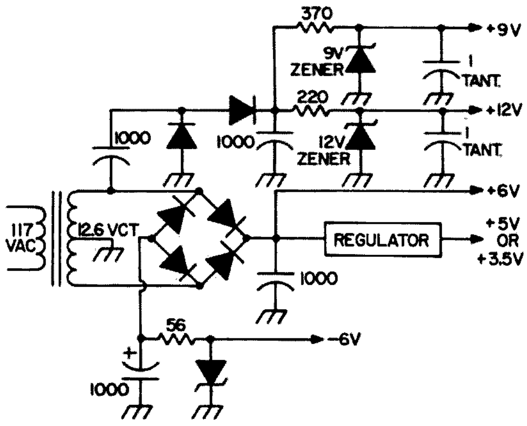

Fig. 3. Power supply circuit.

as possible. The other is that the value of R3 should be chosen to give a zero voltage at the source of Q1 with no signal input. This value can be found by experiment or a 1k resistor used with a 1 or 2k trim control in series to set the correct value. The value will be between 1 and 2k and is almost exactly 1.8k on my unit

There is a drawback to building such a circuit unless you already happen to have the voltages required. You need +12V and –6V. In my frequency counter I only had a 6V transformer with a bridge rectifier to supply the +6V and the regulated +3.5V.

The best solution is given in Fig. 3. The transformer is 12.6V center tapped. The bridge rectifier is actually two full wave rectifiers now. One half supplies the +6V as previously required and the other half supplies the –6V which is filtered and zener regulated for the IC. A voltage doubler is used to get +12V from one half of the transformer secondary, and since the oscillator in the counter uses +9V, this is also zener regulated from this doubler output. It is a good thing to use 1 μF tantalum capacitors on all supply outputs to prevent noise feedback from one supply voltage to the next.

If you don't have a frequency counter yet, you should be working on it. Read all the articles and ads, work up the old gray matter, spend a hundred bucks and have the time of your life without even going FM! (And you will find many uses for it there, as well.)

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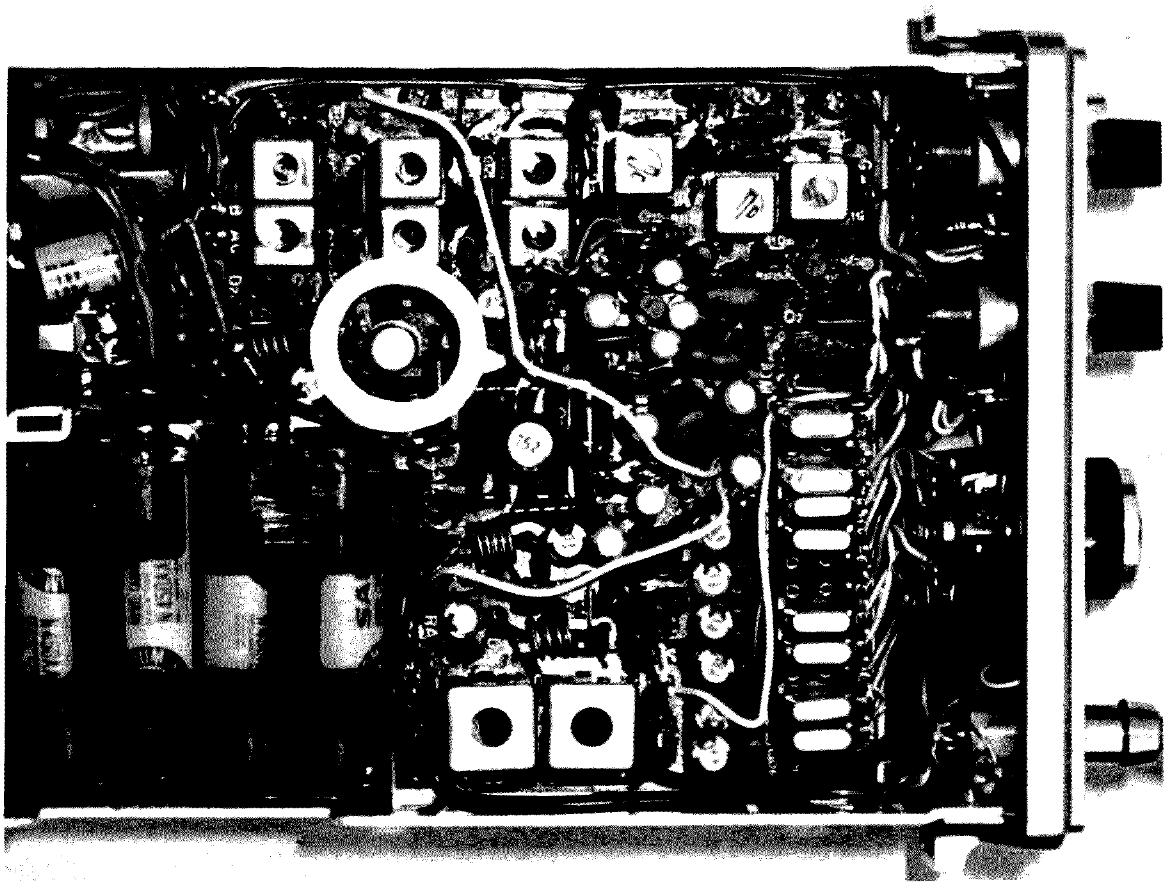
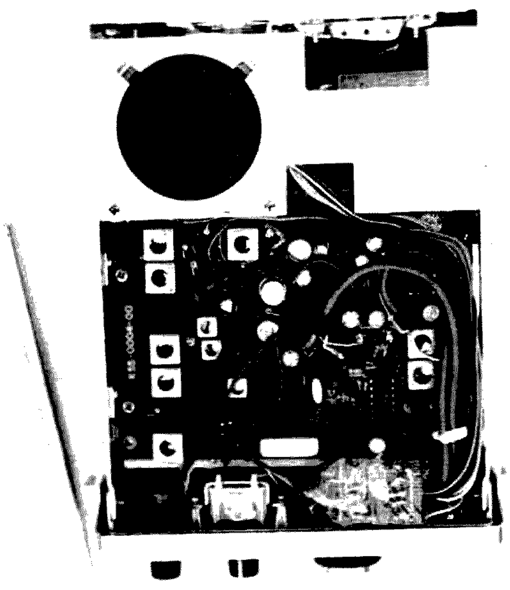
TR-22 MODIFICATION (HIGHER POWER OUTPUT)

One of the most popular 2 meter FM transceivers in use today is the TR-22 from the R.L. Drake Company. Much of its popularity is due to the established reputation for quality of Drake products, but also the versatility of the unit itself. It can be used effectively as a mobile, a portable, and even a base station.

I have used my simplex as far as ten miles, but find that its very best dependability comes working into the repeaters in the Detroit area where I live. As a mobile, I can operate it on the car battery, and with a 5/8 whip, I have no trouble reaching the DART repeater on 04–64 or the GLRA on 16–76 from anywhere in the city or nearby suburbs. But I have also found that with a very simple modification, I could increase its power enough so that it would also hit the same two repeaters when I'm as far as 25 or 30 miles out.



The transistor with the ring around it is the driver (Q28) that we are going to change. To gain access to the foil side of the transmitter board, we turn the rig over and remove the receiver board.



The side of the unit with the speaker has the receiver board. The self-contained antenna has been removed here along with its insulating sleeve, to disclose two mounting screws underneath it. These two screws are removed, along with two more on the left side which are under the wires.

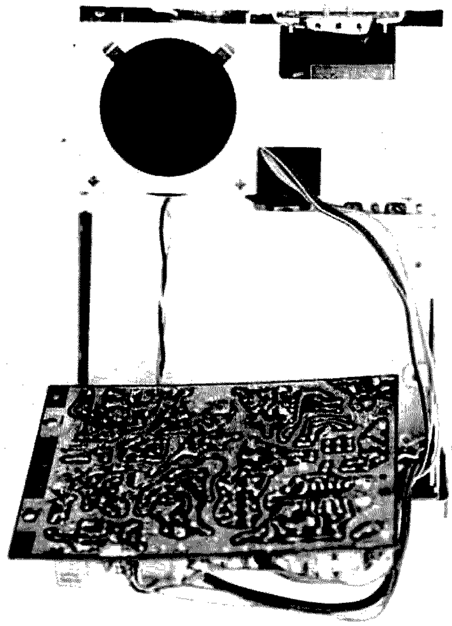
Simple – now, there's a word that I've heard misused quite a bit. I've read some articles where the author used that term with the connotation that meant it was simple if you were an electronic engineer with at least twenty-five years of experience and had $12,000 worth of test equipment at your fingertips to use. But when I define simple, it means that I can do it, and believe me, you can't get any simpler than that. In this case, you replace *one* transistor and peak two coils.

I first heard of the modification from another Detroit area ham, W8FJR (no relation), Roger Moss. He had returned from a vacation trip on the West Coast, and while in the Monterey, California area, he talked with WB6CTA, Jack Lemon, who was using a TR-22 that he had modified to almost double the power output. About two weeks later, I had to make a business trip out there and I talked with Jack a couple of times myself. He reported that he had changed his unit over a year before and had nothing but good luck with it ever since. He convinced me, so like Roger, I changed my own shortly after I got home.

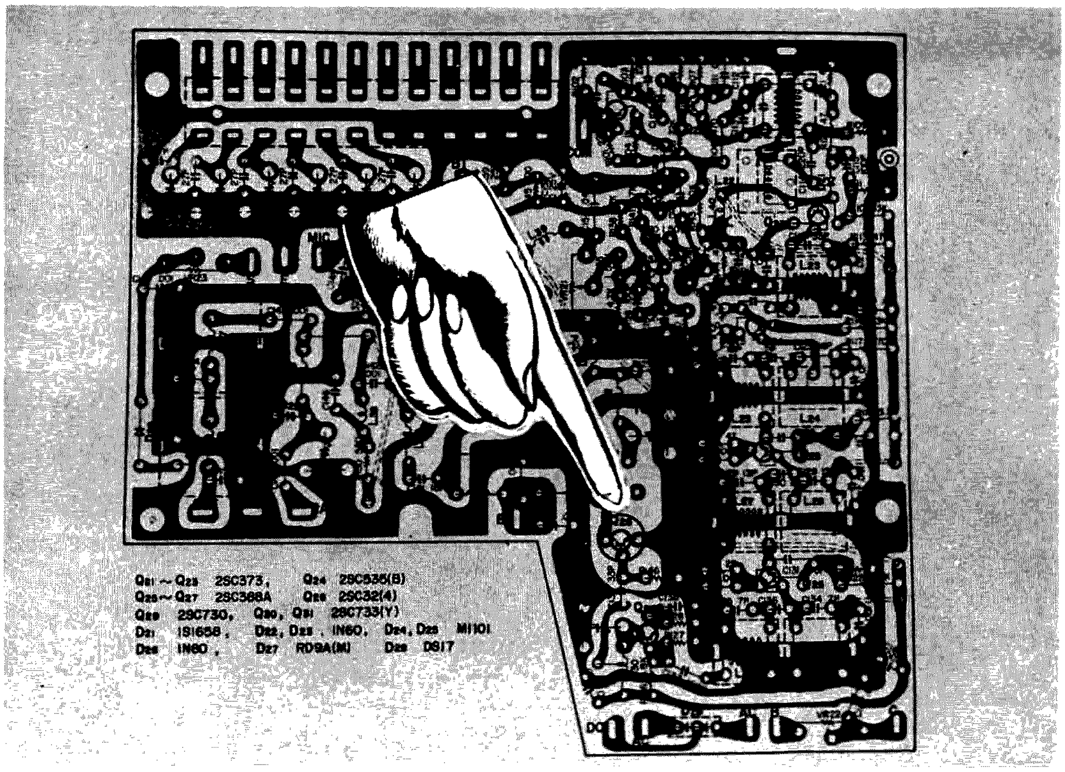
The driver transistor Q28 is replaced with a HEP-75 that is available everywhere, and then the coils on each side of it are peaked with the help of a Bird Wattmeter. With just three solder connections and a little tweaking, you have increased the power out from 1.7 to 2.7W.

I have taken a series of pictures to show how little of the rig must be dismantled to gain access to the board for the actual soldering. In compact rigs like the TR-22, this is an important consideration, as you don't want to put trouble into the rig by messing something up in the process. There are also photos to show the actual differences in output before and after the modification, as well as illustrating how you can gain almost another ten watts when working into an amplifier like the TPL 502B.

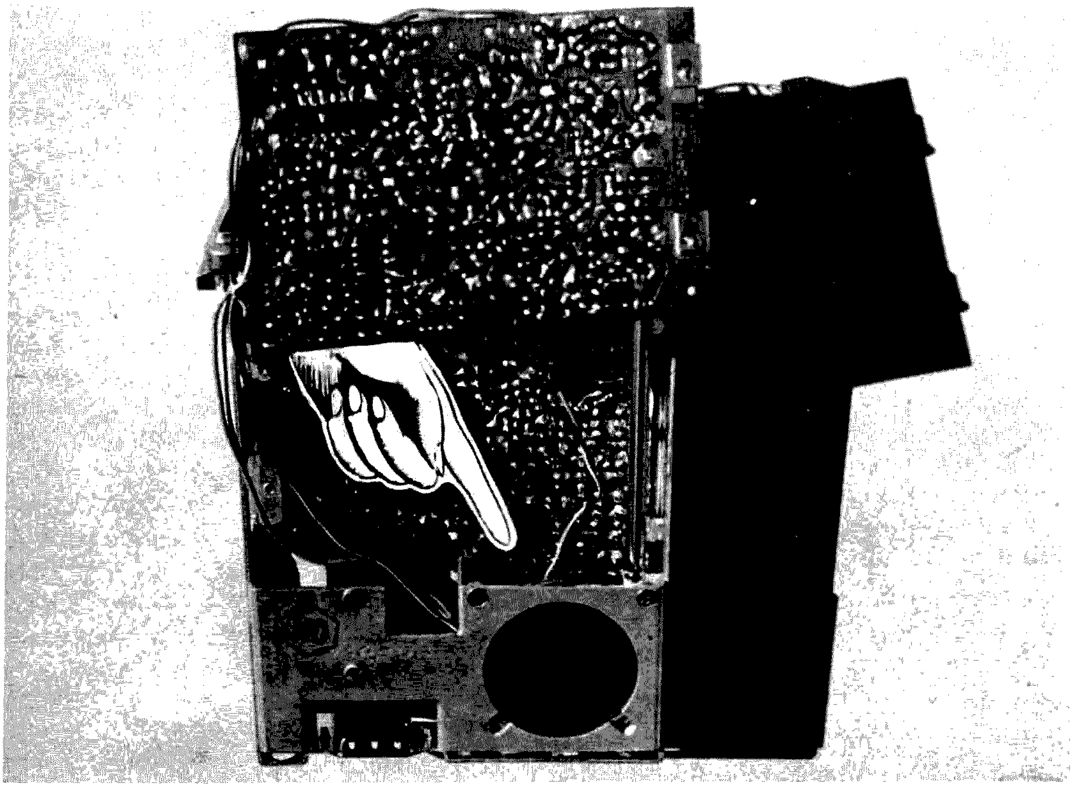
In the photos, my TR-22 will look just a little different than the conventional one which comes from Drake. I have added a



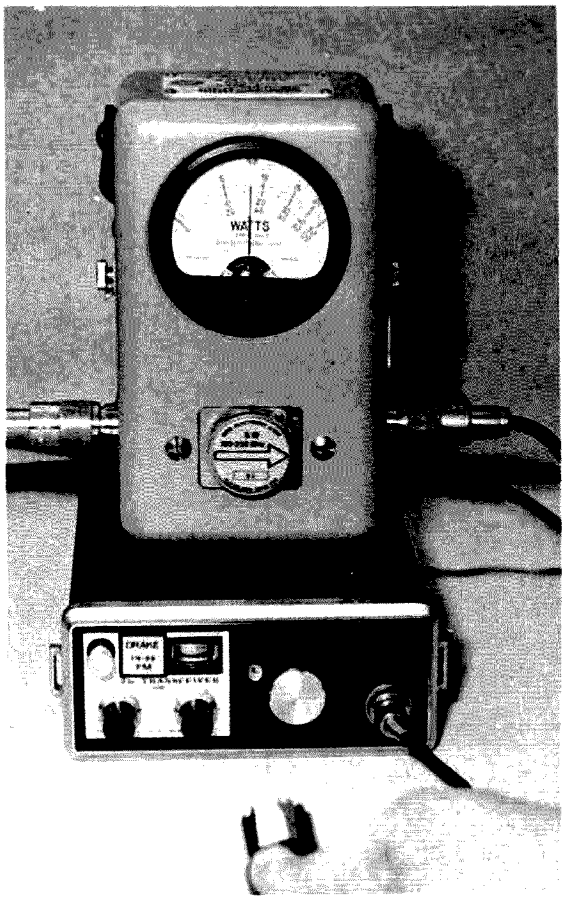
After removing the four screws, take off two more that hold the small right angle brackets to the right side of the chassis frame. Carefully lift the receiver board to the right and out. You will now see the white fiberglass insulating board and the speaker wires.



The transmitter board is illustrated in the owner's manual with the foil side showing how actual connections are made. Here a circle has been drawn around Q28 to show the three connections where the present transistor is removed and the new one substituted.



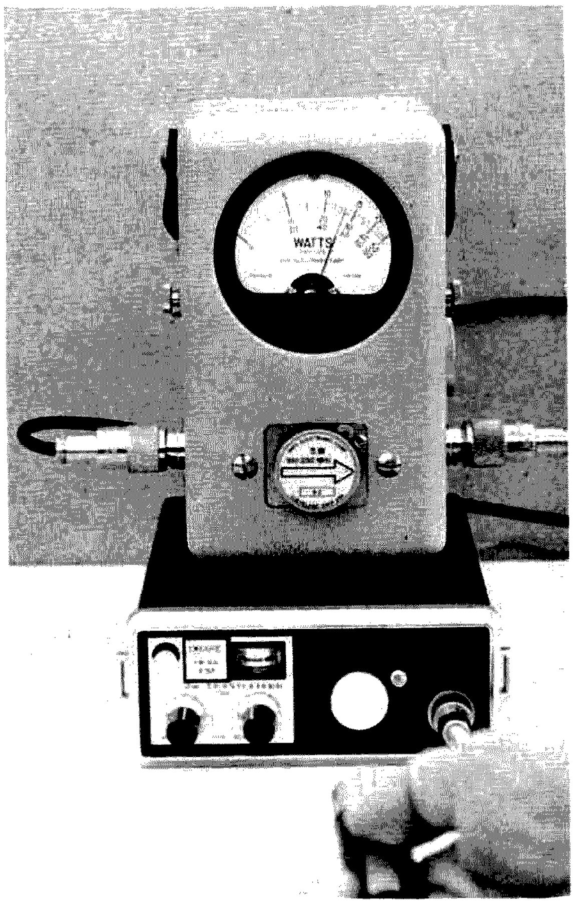
The finger points to the same place on the actual board in the TR-22.



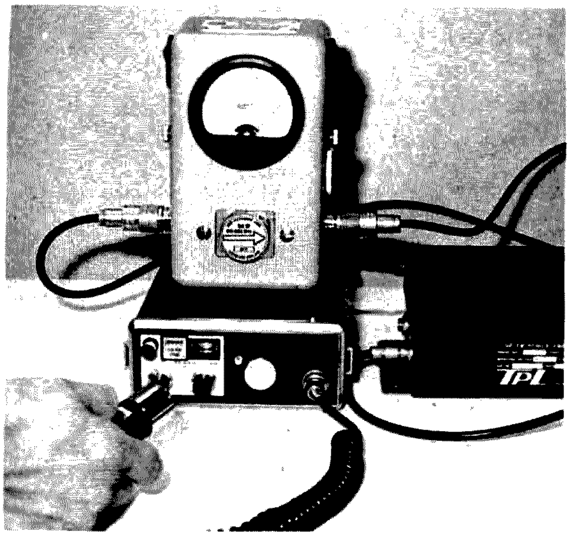
Here an unmodified TR-22 is operated into a dummy load with a Bird Wattmeter showing actual output of 1.7W.

sub-audible tone encoder circuit to it because the two repeaters in the Detroit area require a 100 cycle tone for access. In the plastic bag at the upper right is the miniature circuit board and there are four wires leading from it to the left and down near the speaker to cônnect to the reed. Part of it can be seen above the ac connector at the bottom of the picture. Those wires also appear in the photo showing the fiberglass insulating board under the receiver board. The only wires seen in a regular set at that point will be the two leading to the speaker.

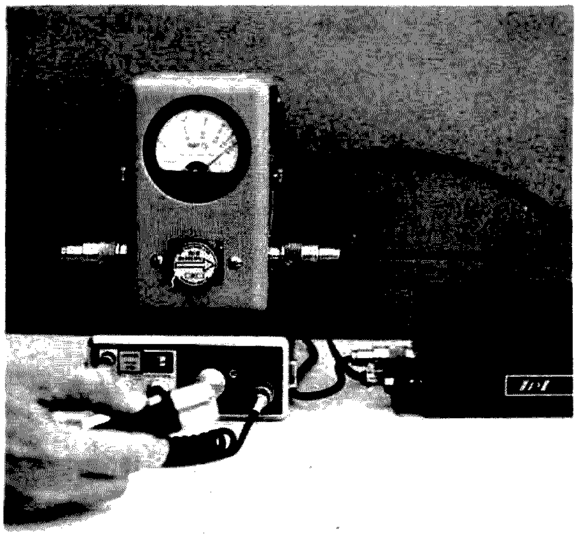
Even though this is a simple modification to accomplish, some precautions need to be taken to keep from turning it into a very complex project. Extreme care must be taken in the handling and movement of the boards to insure against breaking off any wire connections, and there is one other pitfall to be sure to avoid. Normal time to complete the whole job shouldn't be over 20 to 30 minutes, and the rig does not have to be moved around much in the process. However, if you lose the screw connection for the built-in antenna, you will have a hard time recovering it from under the speaker. It goes through a terminal and then the plastic block which is fastened to the side of the chassis frame with a screw. You can either temporarily remount the antenna after the fiberglass board is removed, or just be careful to not move the rig around so that that darned screw does not slide back. I had no problem with this in making the modification to my unit, but in taking it apart again to take the pictures for this article, it did get away from me. In recovering it, the terminal broke off and I had to replace the miniature coax and terminal. It was an extra task which could have been avoided by merely keeping the screw that holds the antenna from sliding back.



With all other conditions the same, the modified transceiver output increases to 2.7W.



This photo and the next one show that a higher input to an amplifier like the TPL 502B will yield a higher output. Here the TR-22, as it comes from Drake, will have an output of 42W, with the aid of the TPL.



With the new driver transistor installed, the power from the amplifier increases to about 49W.

Removing the old transistor and soldering in the new one are done in the same manner as routine soldering jobs. Since the transistors fit flush to the circuit boards, there is no room for using clamps to heat sink the connections while soldering. You should have no trouble here providing the iron is applied to each terminal only long enough to make the connection.

The two coils to be peaked are TC-27 and TC-28 and are plainly marked on the board. Alternating back and forth between the two as the Bird meter is watched for its highest output reading will complete the job.

For our tests and photos, I used a regular 12V automotive battery for the power source, and had the car engine running at fast idle to insure maximum voltage and current available. While it is best to show examples like this in terms of maximums, it should be remembered that the real benefits to raising power output in small amounts is in the lowest ranges, or when operating portable on the self-contained nicads.

There are several Class C amplifiers available to use with the smaller rigs like the TR-22. Drake offers their own AA-22 for 25W out, and the AA-10 for 10W. If you make this modification, you will *not* be able to use the new amp as it has a fixed input to match the TR-22s as they come from the factory. It should also be borne in mind that if your rig is less than 90 days old and therefore still under warranty, it would not be wise to make this or any other modification. No matter what you buy today, the warranty will be void when any unauthorized repairs or modifications are made to the product.

Battery life of the nicads is shortened by the increased output as it naturally takes more power. While this is difficult to measure, it has been estimated by my use – and some others that I know who have done theirs – to be approximately 25% less. For anyone who would find this to be confining to their operation, the original nicads could be replaced with some 500 mil nicads and this would increase the battery life by about 10%.

If you own a TR-22, the decision to make the modification should be made based on your own particular type of operation. For portable and mobile use barefooted, it almost doubles your effective range. If you work into a variable input amplifier, your increase will be in the vicinity of 16 to 20%. My own experience has proven it to be worthwhile, and in the six months since I have done it, I have found no reason to wish that I had not made the modification.

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PART I

TRANSISTOR RF POWER AMPLIFIERS

The following discussion of transistor rf power amplifiers assumes the reader knows his *alphas* and *betas* of transistor theory. He may also have had some experience with transistors in audio and small signal applications. The experience will have conditioned him to the importance of protecting transistors from excessive voltage and heat. But transistors perform so much differently as rf power amplifiers than they do in other applications that the previous experience is not essential to understand the discussion.

Figure 1 is the diagram of a typical transistor rf power amplifier. Transistors have largely replaced vacuum tubes in commercial and amateur VHF mobile transmitters at power levels up to 100 watts or so. Their compactness and high overall efficiency more than compensates for their high first cost. But, except in specialized applications, rf transistors quickly price themselves out of the market at power levels above a few watts in equipment operated from the commercial power lines.

As standard automobile and aircraft batteries deliver nominal voltages of 14 and 28 volts, it is hardly coincidental that most rf power transistors are designed to operate at these voltages. Incidentally, the 28 volt

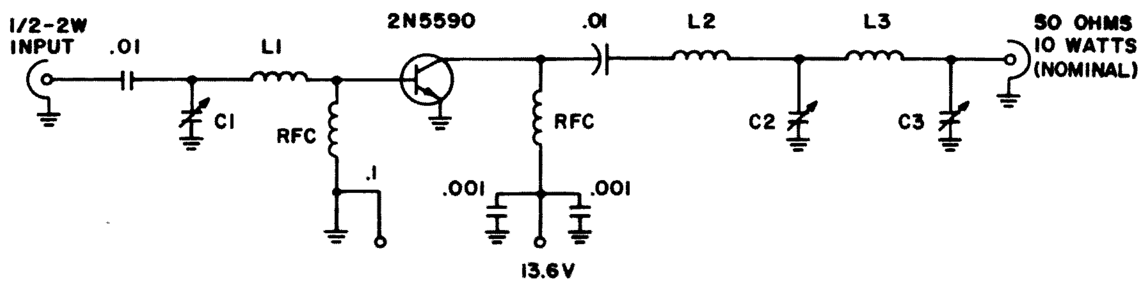

Fig. 1. Typical transistor rf power amplifier.

transistors are appreciably more efficent and cost less, watt per watt, than the 14 volt units.

Virtually all modern rf power transistors are silicon NPN's and are usually operated in the common emitter configuration. Early rf power transistors were easily destroyed by momentary overloads, transients, and stresses developed in tuneup operations. Newer units will not take unlimited abuse, but they are more rugged than the older ones; some of them will even survive being operated as rated voltages and rf drive into an open load circuit for at least a short time.

Operating Parameters

In quick review, the more important transistor operating parameters are voltage, power output, heat dissipation, frequency, and power gain. Of these, excessive voltage is most dangerous to transistor life. A momentary voltage overload of 25% may destroy a transistor.

BV_{ceo} – breakdown voltage, collector to emitter, base open – defines an absolute emitter peak voltage rating established by the transistor manufacturer using pulse techniques. For the user, however, VCC_{max} is usually a more useful figure. VCC_{max} is the maximum safe dc voltage that can be applied between the collector and the emitter of a transistor under any condition of operation.

Typical rated dc VCC_{max} values are 80% of BV_{ceo} for continuous wave (CW) and frequency modulated (FM) services and half that value for high-level amplitude-modulated (AM) service.

Also critical is the transistor base-to-emitter voltage. It has a breakdown rating of three to five volts for virtually all rf power transistors. Fortunately, base voltages are normally quite low in properly operated amplifiers. In class-C amplifiers, for example, the base is often grounded for dc through a low-resistance rf choke, or the base may be slightly reverse biased for highest amplifier output. Conversely, transistor rf linear amplifiers (class-B service) are often slightly forward biased for lowest distortion.

As forward bias increases steady collector direct current rapidly, it may be necessary to reduce the collector dc voltage somewhat to prevent excessive transistor heating, current

"run-away," and "second breakdown" when the transistor base is forward biased.

Power input and heat: Each transistor has a maximum dissipation rating; but, in most units, the maximum rating applies only if heat sinks or other precautions keep the transistor case temperature to a maximum of 25 degrees, *centigrade*. Higher case temperatures require reducing the power input, improved case cooling, or greater transistor output efficiency.

In itself, the maximum direct current rating of a transistor is seldom too important, as other maximums are usually reached before maximum current flows. As a matter of interest, however, peak rf collector currents in power amplifiers are normally three to four times the indicated dc value.

Current runaway: All transistors tend to draw increased current as they become hotter. And as the current increases, the transistor gets hotter, and so on. Normally, current and temperature values rapidly stabilize. But if the transistor overheats, current increases so rapidly that the transistor may be destroyed.

Something like current runaway but more rapid is "second breakdown." It results from the emitter current being concentrated in a small area of the emitter to produce a pin-hole short in the emitter junction. Second breakdown problems increase with frequency and seem particularly troublesome in single sideband amplifiers.

One way to control second breakdown in rf power transistors is "balanced-emitter" construction. It consists of dividing the transistor emitter into up to 100 or more segments and connecting the segments together via internal, low-ohmage resistors. As the current in one segment begins to increase beyond the current in the other segments, the corresponding increase in voltage drop across its associated resistance limits the current through that segment.

Besides helping to control second breakdown, balanced emitter construction introduces a small amount of negative feedback into the transistor amplifier. This feedback improves linearity and stability. Power gain is also decreased slightly, but this is of no practical importance in most rf power amplifiers.

Gain, frequency, and stability: The current gain of a transistor is usually measured at a frequency of 1 kHz. As illustrated in Fig. 2, however, the gain varies with frequency. The shape of the gain-frequency curve is similar for all transistors, although the frequencies involved may be different.

Following the curve, the 1 kHz current gain remains essentially constant as the frequency is increased until a knee in the curve is reached. The point in the knee where the transistor current gain has dropped to 70.6% of its 1 kHz value is called the transistor "cut-off frequency." In terms of power, the point represents a 3 dB loss in gain. Beyond the knee of the curve, the transistor current gain decreases at the rate of 50% per octave.

In applications (such as high-fidelity amplifiers) where uniform amplification of frequencies over many octaves is required, a cut-off frequency at least as high as the top frequency to be amplified is required. While many power transistors have low cut-off frequencies, it is not difficult to find audio power transistors with cut-off frequencies of around 20 kHz.

It is difficult, however, to construct transistors that have both high-power capabilities and high cut-off frequencies. Consequently, power transistors with cut-off frequencies are very rare; nevertheless, transistor rf power amplifiers for frequencies up to and above 500 MHz are common. Obviously,

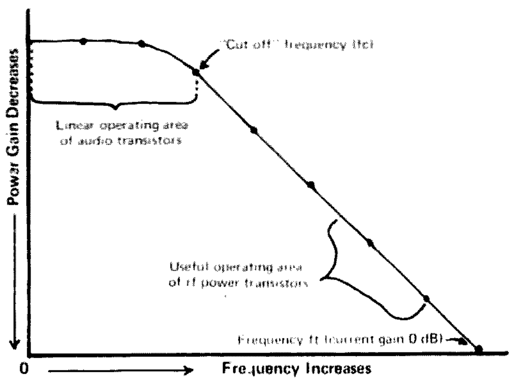

Fig. 2. Typical gain-frequency curve of all transistors. Their power gain is essentially constant from dc to the transistor cut-off frequency (fc), where it has dropped 3 dB. From fc to frequency ft, the power gain decreases at the rate of 6 dB per octave – equivalent to a 3 dB per octave decrease of current gain.

transistors are useful far above their cut-off frequencies. The story is this:

Above its cut-off frequency, the current gain of a transistor continues to decrease at the rate of 3 dB per octave (equivalent to a 6 dB decrease in power gain) until the current gain has decreased to unity or 0 dB. The frequency at which the current gain drops to 0 dB is called the "current-gain, bandwidth product," for the reasons illustrated, and is identified by the symbol *Ft.*[1]

Although the transistor gain varies inversely with frequency above its cut-off frequency, a conventional signal is so narrow, compared to an octave, on frequencies above a MHz or so that all components of the signal are amplified equally. On the other hand, the fact that transistor gain does decrease above its cut-off frequency is one reason that rf power amplifiers are practical.

You see, the dynamic characteristics of large-signal transistors change so radically during each operating cycle that neutralization to control self-oscillations in transistor rf power amplifiers is ineffective. But experience has shown that, if power gain is held to a maximum of approximately 15 dB per stage, a well-designed transistor rf power amplifier is stable without neutralization.

Power gain is controlled by selecting a transistor that is operating approximately two octaves below its *Ft* frequency. Commercial practice is to aim for a gain of around 10 dB per stage for a typical transistor; so that inserting a particularly "hot" transistor in the amplifier will not push the stage into instability.

As most commercial and military mobile services operate on frequencies above 100 MHz, most rf power transistors are designed to operate at these frequencies. As a result, their power gains are embarrassingly high at frequencies below 30 MHz. Nevertheless, a number of audio and switching transistors with *Ft's* between 10 and 100 MHz work satisfactorily as rf power amplifiers in the lower-frequency amateur bands.

1. The transistor still has power gain at frequency ft, even though its current gain is unity there. This follows because the transistor output resistance is greater than its input resistance. This fact is of minor importance, except when an effort is made to make a transistor operate at the highest possible frequency.

Why the frequency *Ft* is called the "current gain bandwidth product:" Assume that a transistor has a current gain of 1 dB at 400 MHz. One times 400 MHz equals a product of 400 MHz. At 200 MHz (one octave lower in frequency) the transistor current gain is 2. Two times 200 MHz equals 400 MHz. at 100 MHz, the product is 4 X 100 MHz = 400 MHz, etc. As power varies as to the square of the current, the power gain of this hypothetical transistor is 4 (6 dB) at 200 MHz and 16 (12 dB) at 100 MHz.

Coupling circuits: A transistor or tube is useless as an rf amplifier without means of coupling power into and out of it. To do the job efficiently, the coupling devices must match the impedances of the transistor or the tube to its source and load impedances. In the process, the coupling circuits provide selectivity to prevent distortion products generated in the amplifier from reaching its load – especially important when the load is an antenna.

An output circuit Q of 10 to 12 is usually sufficient in vacuum tube rf amplifiers. But rf power transistors normally generate more distortion products than tubes do; therefore higher Q, resulting in greater selectivity, is desirable in transistor coupling circuits.

Simple parallel-resonant or *pi* net coupling circuits normally work well with the high impedances of vacuum tubes. But transistor impedances are so low that other types of coupling circuits are desired in rf power amplifiers. A simple *L* network, for example, can be designed to match virtually any resistance or impedance to virtually any other impedance or resistance. Unfortunately, when the ratio between the two impedances or resistances is low, the resultant Q of the *L* network is low.

Fortunately, two or more networks may be combined to obtain the desired Q and impedance match. In Fig. 1, for example, the input circuit is a simple *L* network, and the output circuit is a combined *L-pi* network.

The second part of this articles continues the discussion of the design of transistor rf power amplifiers. It also contains all component values for practical transistor amplifiers for the amateur frequencies between 3.5 and 148 MHz.

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LIGHT BULBS AS RF POWER INDICATORS

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The major appeal to the amateur – as well as some commercial applications – of light bulbs as rf power indicators is low cost. To this must be added the universal availability of bulbs and screwbase sockets for pennies.

As low cost is of primary interest to well over 50% of those interested in any project, and as I have always had an insatiable desire to find out the why's and wherefore's of standard light bulbs as rf power indicators, I decided it might be the opportune time to do a resarch project and determine once and for all just which bulbs might be suitable and which might not be, and also to determine whether light bulbs would make *good* rf power indicators, or poor, and to find out what precautions might have to be taken if one decided he was going to take this low-cost path of determining his transmitter output power rather than go for a more expensive power output meter.

Also, power output meters in the higher wattage ranges become quite expensive compared to the $2 to $5 which might be expended in a light bulb indicator. In general, porcelain screw bases are available for from 12¢ to 25¢ each, and bulbs from 15¢ to 65¢ each, and not more than four of each are necessary for up to 3 KW power indication.

Table 1 lists most of the common types of electric light bulbs readily available. One look at this table immediately reveals why such light bulbs might not be such good rf power indicators as some folks may have thought they were in the past. It also reveals that some very special precautions have to be taken in using them, or the user may find he has overloaded his transmitter and burned up a few components which might be expensive to replace.

The extremely high ratio of cold to hot filament resistance in all types of these bulbs immediately struck me as being the most undesirable factor in using them.

It is very easy to see, for instance, that if one wished to use a 250W bulb for indication on a 250W transmitter, and he computed the resistance at 250W to be 53Ω, (which it is, but only when *hot*), he would assume he had just about a perfectly matched indicator to plug in in place of his 52.5Ω feed line.

However, from this table, it is apparent that this 53Ω resistance is attained *only* at full brilliance and wattage, and the actual cold resistance is only 3.5Ω. In other words, if the bulb were connected to the antenna terminals of the transmitter, and the trans-

Table 1
Variation in Resistance, Cold to Hot State, Common Variety of Electric Light Bulbs.

Bulb Rating Watts At 115V	Cold Filament Resistance	Hot Filament Resistance	Ratio Cold to Hot Filament Res. (Approx.)
7.5	166	1750	1 to 10
25	40	529	1 to 13
40	27	331	1 to 12
60	20	219	1 to 11
100	9	132	1 to 15
150	6	83	1 to 14
200	4.5	65	1 to 14
250	3.5	53	1 to 15
500	2	26	1 to 13
750	1+	17.7	1 to 15

mitter keyed full power, the transmitter would be looking into *not* 53Ω, but 3.5Ω, which is a lot of difference, and an extremely low value for any pi network to match.

For a few seconds, until the filament attained full brilliance, the transmitter would be subjected to a terrific overload, due to this impedance mismatch.

Therefore the first precaution which might be emphasized in using light bulbs would be *not* to key the transmitter at full power with a cold bulb, but to gradually bring the power from some lower value to full power as the bulb attains full brightness (and hot, matching resistance).

Not until I got into this project did I realize the very high ratio of resistance of these filaments from the cold to hot state; I don't suppose very many people do. It also brings to mind how the house electric meter must jump every time a bulb is snapped on in the house. This is not an ad for those light dimmers being sold at all the electrical stores, but it sure brings to mind that power bills could be cut appreciably through their use, i.e., bringing the bulb gradually to full brilliance instead of just snapping on a switch.

Getting back to the bulbs, Table 2 gives in various configurations series, and/or parallel combinations which would be most likely to give the amateur a load for a particular transmitter power output, in nominal impedances near 52 and 72Ω. If the configuration mentions 200W, this does not mean that it would be suitable for indicating the output of a 100W output transmitter, because at half brightness, the resistance offered by the bulb is not identical to that at full brightness.

While a differance of an ohm or two would not be serious, nor would a difference of as much as five, or even ten watts, at high power levels, at low power levels less than 100W, for instance, such differences would be seen to become increasingly serious from the matched impedance standpoint. The configurations given match quite a variety of standard line impedances and a wide range of power outputs. Matches can be obtained for RG-8, 11, 17, 13, 58 and 59 type cable.[1]

One may not realize without measurement that the lead length of the filament support wires alone inside the 25–150W bulbs is very close to 18 cm. Even though they are coiled on a 2 to 1 ratio, the filament is inductive in every sense of the word. At higher frequencies, the filament support wires would appear inductive, and to these factors must be added the parallel capacity of the screwbase shell and the central base contact wafer. Even though such capacity is small, it would become significant at most amateur frequencies above the 30 MHz range. Though the 22 cm total wire path would perhaps indicate a bulb could be used up to 300 MHz, such is not at all the case.

It is easy to see that the sometimes suggested trick of using a capacitor in series with a light bulb as a load should be approached with caution, for it would be very easy indeed to run into a series resonant circuit which might result in damage to the

Table 2
Possible Configurations for Various Power Outputs at Various Impedance Terminations

A. – Nominal 70 to 73Ω Impedance Loads:		
175W Load:	3–60W bulbs in parallel	(73Ω)
	OR	
	7–25W bulbs in parallel	(70Ω)
3,000W Load:		
	4–750W bulbs in series	(71Ω)
B.) Nominal 50 to 55Ω Impedance Loads:		
250W Load:	4–60W bulbs in parallel	(54.9Ω)
500W Load:	2–150W bulbs in series, both paralleled by 1–150W bulb	(55Ω)
1,000W Load:	2–500W bulbs in series	(53.6Ω)
2,250W load:	3–750W bulbs in series	(53.1Ω)

transmitter to which such circuit were connected.

In the course of my preparation of this article, I discussed the ramifications with a number of interested hams. Some of them suggested I extend the research to include the use of the smaller types of indicator (pilot) bulbs as loads for testing out transmitters with power outputs in the 1W to 20W range, not only just for amateur applications, but also with a view to using them as loads in testing FM transmitters.

When one considers that there are well over 100 types of these small bulbs, rated from .001W to 2W, and if all of these were to be considered individually, it could take a vast amount of time – and eventually one would end up with perhaps only five or so of these bulbs that would be at all suitable, so such research was not included in this article. However it did open up a field in which there may be a demand for information and may be the subject of a subsequent article.

Frequency Ranges

The use of standard screw-base ceramic or steatite porcelain light bulb sockets is entirely feasible for all of the configurations shown and will handle all amateur bands, 160 through 10. Naturally the leads from socket to socket should be as short as possible in either the series and/or parallel configurations. I found these leads can be kept to approximately 2 cm for such interconnections. Likewise, the coax termination lead should be kept to 2 cm or less.

If extra precautions as to lead lengths are observed, and the bases of the bulbs removed to enable connections directly to the stem wires, it would appear reasonable to suspect that these bulbs might be used for 6, 5, and perhaps 2 meter bands, but it is also quite evident the 2 meter band would be the practical limit.

One should be able to conjecture that light bulbs as power rf indicators are not quite the equal of well-designed power output meters which maintain their rated impedances over a very wide power output range – bulbs do not – but then, they *are* cheap in comparison.

Visual comparison of brightness is completely satisfactory for comparison purposes. For instance, a 500W bulb connected to the 115V mains should show the same brilliance as one of the 500W bulbs as used in the 1 KW load.

Actually a transmitter supposedly putting out 2,000W PEP is putting out something less than 1,000W with average voice modulation; it would be more of the order of 500–750W average power. Remember that the light bulb is only going to show average power output, not peak, and as ham transmitters are limited to 1,000W dc input to the final amplifier, one cannot expect much more than 500–750W output (average) unless the efficiency of the final amplifier stage approaches 85% which is very unusual, although I am hearing lately that certain high-power transistors are in development which will deliver such high efficiency figures; a bit above that which heretofore has been obtainable with tubes. You should be hearing a lot more about these super-efficiency transistors in the near future; and I expect them to be appearing in certain ham transmitters within a year or so.

Naturally a CW transmitter with the final operated Class C may deliver as much as 850W with 1,000W dc input, while a DSB transmitter on phone could not be expected to deliver more than 650W with Class A or B modulation.

The research and conclusions I reached on this project brought to mind the old subject of using light bulbs in series with primaries of transformers to reduce the secondary output voltages, which is a trick which has been used for years by hams and others. The information contained herein indicates they are not only quite suitable for such usage, but in fact make quite ideal voltage regulators of a sort.

In fact, the question immediately arises as to why bulbs would not make rather ideal voltage regulators for high voltage supplies if used as a variable-resistance dc regulator in the dc leg. This again opens up a field which might bear intense investigation.

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[1] Solid Dielectric RF Transmission Lines, W8LUQ, *Radio News* Oct. 1946.
Line Matching: Table of Power and Voltage Loss in DB, *Radio News* Feb. 1947.

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ECONOMY FILTERS FOR THE COLLINS 75A4

The Collins 75A4 amateur band receiver, although it is over ten years old, is one of the best pieces of amateur equipment available[1]. The selectivity is controlled by mechanical filters. Usually just the 3 kHz mechanical filter is supplied, leaving positions available for two additional filters.

Collins Radio still manufactures mechanical filters specifically for the 75A4 with bandwidths from several hundred Hertz (for CW use) to tens of kilohertz (for AM or other wideband signal use). A worthwhile savings may be obtained by purchasing filters in economy case configurations and making a suitable adapter for the 75A4.

A sharp filter with 500 Hz bandwidth was constructed using a Collins type FA filter mounted in a standard minibox. A broad filter was made using a series of subminiature i-f transformers, again mounted in a standard minibox. The i-f transformers were used because the steep skirts of a mechanical filter were judged an expensive luxury for this application. Broad band mechanical filters are available in economy case configurations.

A savings of at least $15 should be realized by constructing a case for F455FA05 filter. Installing this filter and a plug in a minibox should take a few hours at most. A savings of up to $50 should be realized by constructing a broad filter from

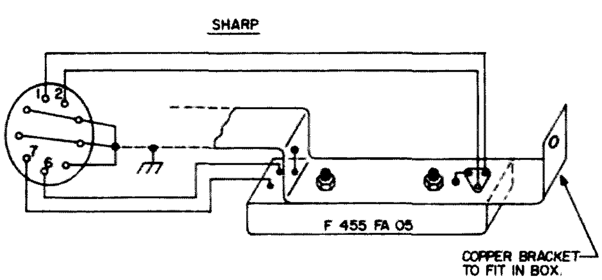

Fig. 1. Sharp filter with 500 Hz bandwidth.

[1] *QST* Nov. 66, page 53.

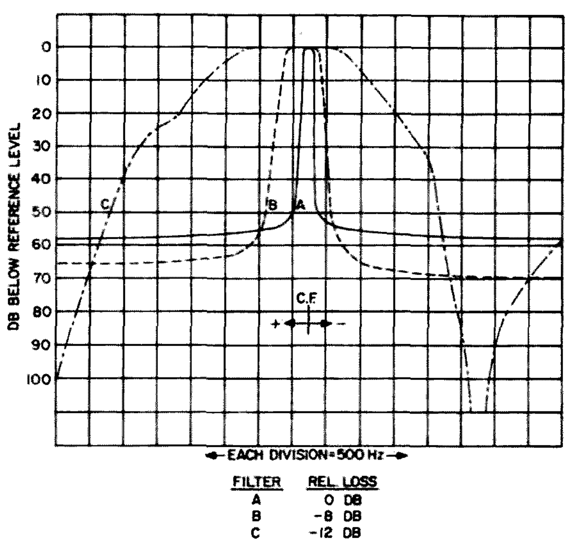

Fig. 2. Results with different filters. A = 500 Hz bandwidth filter; B = 3.1 Hz bandwidth; C= the broad filter described.

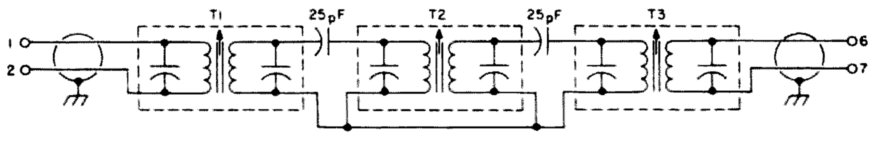

Fig. 3. Schematic of the broad filter.

i-f transformers. The construction time is probably double that of the sharp filter.

The results obtained are shown by the accompanying graph. Curve A is the 500 Hz bandwidth filter, Curve B is the standard 3.1 Hz bandwidth Collins filter supplied with the 75A4, and Curve C is the broad filter. Each curve has been shifted vertically so that its peak in output lies on the 0 dB line. With respect to the 3.1 Hz filter, the 500 Hz filter output was 8 dB higher and the broad filter output was 4 dB lower, each having the same input level.

The increased stop-band feedthrough level on the sharp filter may be due to signal leakage around the filter, or it may just be the filter characteristics. Relatively the same construction technique was used in the sharp and broad filters. Note the extreme attenuation achieved at points by the broad filter.

These measurements were made by first calibrating the s-meter of a 75A4 against a set of accurate attenuators. A calibration curve was thus obtained for the s-meter readings. A fixed signal was then tuned in, and the s-meter readings were plotted as a function of receiver tuning above and below the fixed input.

The performance of the filters has been found to be very good over several years of use. The reduced loss of the sharp filter, together with its narrow bandwidth, makes it very pleasant to use. The broad filter has been useful for VHF work, where network stations are not always exactly on frequency. It also makes AM signals more understandable than the 3.1 kHz filter.

The circuitry is quite standard, and is shown in the accompanying figure. There should be no dc current flowing through the mechanical filter input and output windings. It is my understanding that a modification of early 75A4 receivers is necessary to prevent this. The input and output should be well shielded from each other.

The broad filter consists of three Miller 10-C-1 455 kHz i-f transformers series connected. Both the input and output circuits float. There are no chassis ground connections made inside the filter case. The interstage coupling capacitors were selected to give the same output level as the 3.1 kHz mechanical filter. Increasing the capacity will increase the output level (to a point). A broader response may be obtained by using fewer transformers, or by increasing the coupling capacity to get a double-peaked overcoupled response, or both. I have not tried overcoupling the transformers, so their behavior in this respect is unknown. The maximum possible bandwidth may be obtained with a simple R-C-R coupling network.[2]

The cases were made from 1 1/8 x 2 1/8 by 3 1/4 miniboxes. The components were mounted on a copper bracket the width of the minibox (1 1/8) which was then installed in the minibox. A keyway hole was punched for a 9 pin Vector plug. The keyway must be carefully aligned so the plug will fit in the A4 socket with the minibox sitting squarely in place. The retainer clip for the Vector plug was made from scrap metal, although one may be available.

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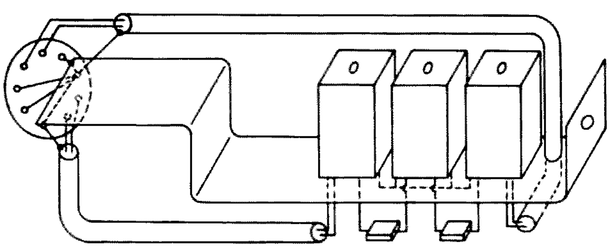

Fig. 4. Pictorial of the broad filter.

[2]An extender was made from a 9 pin plug and socket to permit the broad filter to be tuned for peak output conveniently.

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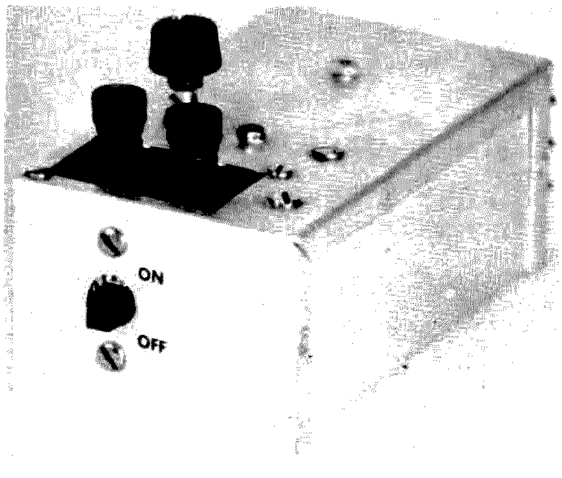
CMBFS

Capacitance Measurement by Frequency Shift

Why, you might ask, should another article be written concerning capacitance measurement when dozens of articles have appeared on this subject in the past? I have reviewed some of them and find that specialized equipment is generally required that may not be available to the average amateur such as a precision calibrated variable capacitor, a grid dip meter, or a capacitance bridge. All techniques required calibrated standards of some sort which usually turn out to be the stumbling block for the average amateur.

What means of calibration is then available to all? The receiver, of course! Every ham has a receiver these days that is calibrated to within 5, 2 and frequently 1 kHz. Even most transceivers are accurate to the latter figure. The problem then is how to use this accurate frequency calibration to measure capacitance. The solution is readily evident – tune a simple self excited transistor oscillator to the high frequency edge of one of the amateur bands; connect the unknown capacitance across the oscillator circuit and measure the new lower frequency on the receiver. All that remains to be done is to derive the expression for relating the frequency shift to the unknown capacitance.



Finished unit.

A basic Hartley oscillator circuit is shown in **Fig. 1**. According to R. F. Shea, *Transistor Circuit Engineering,* John Wiley & Sons, Inc., 1957, the oscillation frequency for a Hartley transistor oscillator is:

$$(1)\ f = \frac{1}{2\pi\sqrt{C\,(L_1 + L_2 + 2M0 - (L_1 L_2 - M^2)\,\frac{h22b}{h11b}}}$$

which looks somewhat unmanageable. Fortunately, the expression can be greatly simplified. L1+L2+2M is nothing more than the total inductance L of the circuit. Let the second term:

$$(L_1 L_2 - M^2)\,\frac{h22b}{h11b} = A$$

then

$$(2)\ f = \frac{1}{2\pi\sqrt{LC + A}}$$

A is a constant involving the inductive terms L1, L2, & M as well as the transistor parameters h22b and h11b and **Figs. 2 & 1.** If the assumption is made that this term is negligible, then the familiar expression for the resonant frequency of a tuned circuit results.

$$(3)\quad f = \frac{1}{2\pi\sqrt{LC}}$$

Suppose we assume that (3) determines the oscillator frequency for the moment. More will be said about the transistor loading factor "A" later.

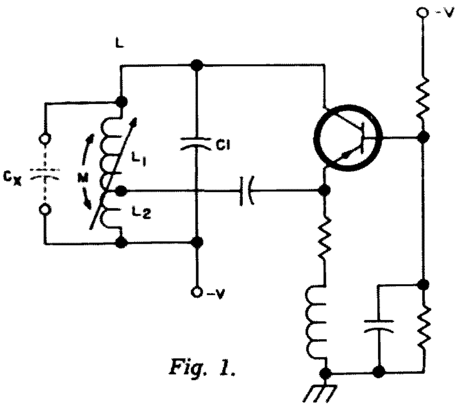


Fig. 1.

It can be shown (see Appendix I) that

$$(4)\quad C_X = \left(C_1 \frac{1}{1 - \frac{2\Delta f}{f_1} + \frac{\Delta f^2}{f_1^{\,2}}} - 1 \right)$$

where Cx= unknown capacitance
f1 = basic oscillator frequency in kHz.
Δf= shift in frequency in kHz due to placing unknown capacitor Cx across tuned circuit
C1= fixed, known tank circuit capacitance

The $\Delta f^2/f1^2$ term is very small compared to 2Δf/f1 and can be neglected for the moment. Equation (4) reduces to:

$$(5)\quad C_X = C_1 \left(\frac{1}{1 \quad \frac{2\Delta f}{f_1}} - 1 \right)$$

The significant facts that emerge from this equation are that the unknown capacitance Cx depends only on the shift in frequency Δf, the basic frequency f1 and the tank capacitance C1. Cx is thus independent of L and other factors. To measure large values of Cx, C1 must be large which dictates the use of the lowest frequency amateur band. 80 meters was selected since 160 isn't available on many receivers. Fortunately, 80 meters is also a wide band and contributes to the range of Cx.

Note that the shift in frequency (Δf) is much more important in determining Cx than the basic frequency f1. If f1 is off by 1

Δf, kHz	C_x, pF	Δf, kHz	C_x, pF	Δf, kHz	C_x, pF	Δf, kHz	C_x, pF	Δf, kHz	C_x, pF
.0	.0000	1.0	.5140	2.0	1.0284	3.0	1.5432	4.0	2.0584
5.0	2.5740	6.0	3.0900	7.0	3.6063	8.0	4.1231	9.0	4.6402
10.0	5.1577	11.0	5.6756	12.0	6.1939	13.0	6.7126	14.0	7.2317
15.0	7.7512	16.0	8.2710	17.0	8.7913	18.0	9.3119	19.0	9.8330
20.0	10.3544	21.0	10.8762	22.0	11.3984	23.0	11.9210	24.0	12.4440
25.0	12.9674	26.0	13.4912	27.0	14.0154	28.0	14.5400	29.0	15.0650
30.0	15.5904	31.0	16.1161	32.0	16.6423	33.0	17.1689	34.0	17.6959
35.0	18.2232	36.0	18.7510	37.0	19.2791	38.0	19.8077	39.0	20.3367
40.0	20.8661	41.0	21.3958	42.0	21.9260	43.0	22.4566	44.0	22.9875
45.0	23.5189	46.0	24.0507	47.0	24.5829	48.0	25.1155	49.0	25.6485
50.0	26.1819	51.0	26.7157	52.0	27.2499	53.0	27.7845	54.0	28.3195
55.0	28.8549	56.0	29.3908	57.0	29.9270	58.0	30.4637	59.0	31.0007
60.0	31.5382	61.0	32.0761	62.0	32.6144	63.0	33.1531	64.0	33.6922
65.0	34.2317	66.0	34.7716	67.0	35.3120	68.0	35.8527	69.0	36.3939
70.0	36.9365	71.0	37.4775	72.0	38.0199	73.0	38.5627	74.0	39.1059
75.0	39.6496	76.0	40.1937	77.0	40.7382	78.0	41.2831	79.0	41.8284
80.0	42.3741	81.0	42.9203	82.0	43.4669	83.0	44.0139	84.0	44.5613
85.0	45.1091	86.0	45.6573	87.0	46.2060	88.0	46.7551	89.0	47.3046
90.0	47.8546	91.0	48.4049	92.0	48.9557	93.0	49.5069	94.0	50.0585
95.0	50.6106	96.0	51.1630	97.0	51.7159	98.0	52.2693	99.0	52.8230
100.0	53.3772	101.0	53.9318	102.0	54.4868	103.0	55.0423	104.0	55.5982
105.0	56.1545	106.0	56.7112	107.0	57.2684	108.0	57.8260	189.0	58.3840
110.0	58.9425	111.0	59.5014	112.0	60.0607	113.0	60.6204	114.0	61.1806
115.0	61.7412	116.0	62.3023	117.0	62.8638	118.0	63.4257	119.0	63.9880
120.0	64.5508	121.0	65.1141	122.0	65.6777	123.0	66.2418	124.0	66.8063
125.0	67.3713	126.0	67.9367	127.0	68.5025	128.0	69.0688	129.0	69.6356
130.0	70.2027	131.0	70.7703	132.0	71.3384	133.0	71.9068	134.0	72.4758
135.0	73.0451	136.0	73.6149	137.0	74.1852	138.0	74.7559	139.0	75.3270
140.0	75.8986	141.0	76.4706	142.0	77.0431	143.0	77.6160	144.0	78.1894
145.0	78.7632	146.0	79.3374	147.0	79.9121	148.0	80.4873	149.0	81.0629
150.0	81.6389	151.0	82.2154	152.0	82.7924	153.0	83.3697	154.0	83.9476
155.0	84.5259	156.0	65.1046	157.0	85.6838	158.0	86.2635	159.0	86.8436
160.0	87.4241	161.0	88.0052	162.0	88.5866	163.0	89.1685	164.0	89.7509
165.0	90.3338	166.0	90.9170	167.0	91.5008	168.0	92.0850	169.0	92.6696
170.0	93.2548	171.0	93.8403	172.0	94.4264	173.0	95.0129	174.0	95.5998
175.0	96.1872	176.0	96.7751	177.0	97.3634	178.0	97.9522	179.0	98.5415
180.0	99.1312	181.0	99.7214	182.0	100.3120	183.0	100.9031	184.0	101.4947
185.0	102.0868	186.0	102.6793	187.0	103.2723	188.0	103.8657	189.0	104.4596
190.0	105.0540	191.0	105.6488	192.0	106.2441	193.0	106.8399	194.0	107.4362
195.0	108.0329	196.0	108.6301	197.0	109.2278	198.0	109.8259	199.0	110.4245
200.0	111.0236	201.0	111.6231	202.0	112.2232	203.0	112.8237	204.0	113.4246
205.0	114.0261	206.0	114.6280	207.0	115.2304	208.0	115.8333	209.0	116.4367
210.0	117.0485	211.0	117.6448	212.0	118.2496	213.0	118.8549	214.0	119.4606
215.0	120.0669	216.0	120.6736	217.0	121.2808	218.0	121.6884	219.0	122.4966
220.0	123.1052	221.0	123.7144	222.0	124.3240	223.0	124.9341	224.0	125.5446
225.0	126.1557	226.0	126.7672	227.0	127.3793	228.0	127.9918	229.0	128.6048
230.0	129.2183	231.0	129.8323	232.0	130.4467	233.0	131.0617	234.0	131.6772
235.0	132.2931	236.0	132.9095	237.0	133.5265	238.0	134.1439	239.0	134.7618
240.0	135.3802	241.0	135.9991	242.0	136.6185	243.0	137.2384	244.0	137.8587
245.0	138.4796	246.0	139.1010	247.0	139.7229	248.0	140.3452	249.0	140.9681
250.0	141.5915	251.0	142.2153	252.0	142.8397	253.0	143.4645	254.0	144.0899
255.0	144.7157	256.0	145.3421	257.0	145.9690	258.0	146.5963	259.0	147.2242
260.0	147.8526	261.0	148.4815	262.0	149.1109	263.0	149.7407	264.0	150.3711
265.0	151.0020	266.0	151.6334	267.0	152.2654	268.0	152.8978	269.0	153.5307
270.0	154.1642	271.0	154.7981	272.0	155.4326	273.0	156.0676	274.0	156.7030
275.0	157.3390	276.0	157.9755	277.0	158.6126	278.0	159.2501	279.0	159.8881
280.0	160.5267	281.0	161.1658	282.0	161.8054	283.0	162.4455	284.0	163.0861
285.0	163.7273	286.0	164.3689	287.0	165.0111	288.0	165.6538	289.0	166.2970
290.0	166.9408	291.0	167.5850	292.0	168.2298	293.0	168.8751	294.0	169.5209
295.0	170.1673	296.0	170.8142	297.0	171.4615	298.0	172.1095	299.0	172.7579
300.0	173.4069	301.0	174.0564	302.0	174.7064	303.0	175.3570	304.0	176.0081
305.0	176.6597	306.0	177.3118	307.0	177.9645	308.0	178.6177	309.0	179.2714
310.0	179.9257	311.0	180.5805	312.0	181.2358	313.0	181.8917	314.0	182.5481
315.0	183.2050	316.0	183.8625	317.0	184.5205	318.0	185.1790	319.0	185.8381
320.0	186.4977	321.0	187.1578	322.0	187.8185	323.0	188.4797	324.0	189.1415
325.0	189.8038	326.0	190.4666	327.0	191.1300	328.0	191.7940	329.0	192.4584
330.0	193.1234	331.0	193.7890	332.0	194.4551	333.0	195.1218	334.0	195.7890
335.0	196.4567	336.0	197.1250	337.0	197.7938	338.0	198.4632	339.0	199.1331
340.0	199.8036	341.0	200.4747	342.0	201.1462	343.0	201.8184	344.0	202.4911
345.0	203.1643	346.0	203.8381	347.0	204.5124	348.0	205.1873	349.0	205.8628
350.0	206.5388	351.0	207.2154	352.0	207.8924	353.0	208.5701	354.0	209.2484
355.0	209.9272	356.0	210.6065	357.0	211.2864	358.0	211.9669	359.0	212.6479
360.0	213.3295	361.0	214.0117	362.0	214.6944	363.0	215.3777	364.0	216.0615
365.0	216.7459	366.0	217.4309	367.0	218.1164	368.0	218.8025	369.0	219.4892
370.0	220.1765	371.0	220.8643	372.0	221.5526	373.0	222.2416	374.0	222.9311
375.0	223.6212	376.0	224.3119	377.0	225.0031	378.0	225.6949	379.0	226.3873
380.0	227.0802	381.0	227.7737	382.0	228.4678	383.0	229.1625	384.0	229.8578
385.0	230.5536	386.0	231.2500	387.0	231.9470	388.0	232.6446	389.0	233.3427
390.0	234.0414	391.0	234.7407	392.0	235.4406	393.0	236.1411	394.0	236.8421
395.0	237.5438	396.0	238.2460	397.0	238.9488	398.0	239.6522	399.0	240.3561
400.0	241.0607	401.0	241.7659	402.0	242.4716	403.0	243.1779	404.0	243.8849
405.0	244.5924	406.0	245.3005	407.0	246.0091	408.0	246.7184	409.0	247.4283
410.0	248.1387	411.0	248.8498	412.0	249.5615	413.0	250.2737	414.0	250.9865
415.0	251.7000	416.0	252.4141	417.0	253.1287	418.0	253.8439	419.0	254.5597
420.0	255.2762	421.0	255.9932	422.0	256.7109	423.0	257.4291	424.0	258.1479
425.0	258.8674	426.0	259.5874	427.0	260.3081	428.0	261.0293	429.0	261.7512
430.0	262.4737	431.0	263.1968	432.0	263.9204	433.0	264.6448	434.0	265.3697
435.0	266.0982	436.0	266.8213	437.0	267.5480	438.0	268.2754	439.0	269.0033
440.0	269.7319	441.0	270.4611	442.0	271.1909	443.0	271.9213	444.0	272.6524
445.0	273.3840	446.0	274.1163	447.0	274.8492	448.0	275.5827	449.0	276.3168
450.0	277.0516	451.0	277.7869	452.0	278.5229	453.0	279.2595	454.0	279.9968
455.0	280.7346	456.0	281.4732	457.0	282.2122	458.0	282.9520	459.0	283.6924
460.0	284.4334	461.0	285.1750	462.0	285.9172	463.0	286.6601	464.0	287.4036
465.0	288.1478	466.0	288.8925	467.0	289.6379	468.0	290.3840	469.0	291.1306
470.0	291.8780	471.0	292.6259	472.0	293.3745	473.0	294.1237	474.0	294.8735
475.0	295.6240	476.0	296.3752	477.0	297.1269	478.0	297.8793	479.0	298.6324
480.0	299.3861	481.0	300.1404	482.0	300.8954	483.0	301.6510	484.0	302.4073
485.0	303.1642	486.0	303.9218	487.0	304.6800	488.0	305.4388	489.0	306.1984
490.0	306.9585	491.0	307.7193	492.0	308.4807	493.0	309.2429	494.0	310.0056
495.0	310.7690	496.0	311.5331	497.0	312.2978	498.0	313.0632	499.0	313.8292

Fig. 2. Frequency-shift capacitance equivalents.

kHz, the effect is only 1 kHz in 4000 kHz whereas a 1 kHz change in Δf has a much larger effect since Δf can vary between 0 to 500 kHz. What this means is that the linearity of your receiver dial calibration is more important than the absolute accuracy. Setting the basic oscillator frequency to 4001 instead of 4000 isn't much cause for concern. The shift in frequency is the important parameter.

The accuracy of Cx is dependent on the accuracy of CI. If CI is accurate to 5%, Cx will be accurate to 5%. If CI is accurate to ½%, Cx will be likewise. You can buy as much accuracy as you are willing to pay for. 5% is sufficient for most amateur applications but great accuracy can be achieved inexpensively in several ways, for example, padding up an undersized CI if there is precision capacitance measuring equipment available. If not, precision capacitances can be purchased from industrial electronic supply houses. It seems hardly worth buying a 5% unit for 60 cents when a 1% unit can be obtained for \$1.37. The Cornell Dubilier type CD19F102F500 capacitor can be obtained from major supply houses. Arco Electronics, Community Drive, Great Neck, N.Y. 11022 is the distributor for El Menco type DM20 capacitors which can be obtained at 1% or better tolerance on special order.

One nice feature of the CMBFS technique is that the oscillator is not critical. There is no precision or long term stability required. Temperature, voltage changes, etc. will have no appreciable effect. The only stability required is that long enough to last for 15 seconds – the length of time it takes to make a measurement. Inaccuracies are balanced out by adjusting the variable inductance L to produce a 4000 kHz oscillation frequency immediately prior to the capacitance measurement.

Returning to an earlier assumption, the next step is to verify the accuracy of equation (4) with regard to omission of the transistor loading factor "A". An oscillator, to be described in the next section, was constructed using a CI value of 1000 pF accurate to within ¼ of 1% as measured on a precision laboratory bridge. A known Cx of 312.3 pF ± ¼% produced a frequency shift of 497 kHz. If these values are substituted into equation (4), Cx is calculated to be 303.9 pF or 8.4 pF less than it should be. This amounts to an error of 2.7% and is attributed directly to transistor loading shifting the oscillator frequency. Another way of looking at it is that the transistor has added 27.7 pF of capacitance to the tuned circuit. The term "transistor loading factor" is used somewhat loosely. It also includes the circuit stray capacitances. To allow for the loading effect a constant K1 is inserted into equation (4).

$$(6)\quad C_x = K_1 C_1 \left(\frac{1}{1 - \frac{2\Delta f}{f_1} + \frac{\Delta f^2}{f_1^2}} - 1 \right)$$

where $K_1 = 1.02768$

The term A could have been calculated directly from the inductance and transistor parameters but it would have been for an "average" transistor. The question is "What is the variability in this term with different transistors in the circuit?" To answer this question quantities of different transistors were plugged into the circuit and the change in Δf was noted. Intermediate frequency type 2N404's produced a variation of ± 6 kHz shift out of 500 kHz. The high frequency type 2N964 produced a negligible variation in shift of ± 1¼ kHz out of 500 kHz and were therefore judged the most satisfactory. The Motorola HEP 1 at 89 cents acts the same as the 2N964 and is recommended.

The average ham would hardly want to solve equation (6) every time he wanted to make a capacitance measurement and therefore a computerized solution was sought. With 1 KC increments in Δf being available and covering a 500 kHz range – 500 calculations have to be made. The computer is a natural tool for this job. The problem was programmed for a Univac 1107 and all 500 points were calculated in seven seconds. It would have taken me 41 hours with a desk calculator to get the same answers with many mistakes. The results are photographically reproduced in Fig. 2. Don't be fooled by all of the significant digits in the capacitance columns. Although the accuracy is inherently there, your answer is limited by the accuracy of C1 and your receiver calibration.

Circuit and Construction Details

TR1, LI, CI of Fig. 3 form the Hartley Oscillator circuit. TR2 is a buffer amplifier driven from the emitter tap on LI. Its function is to isolate any loading on the

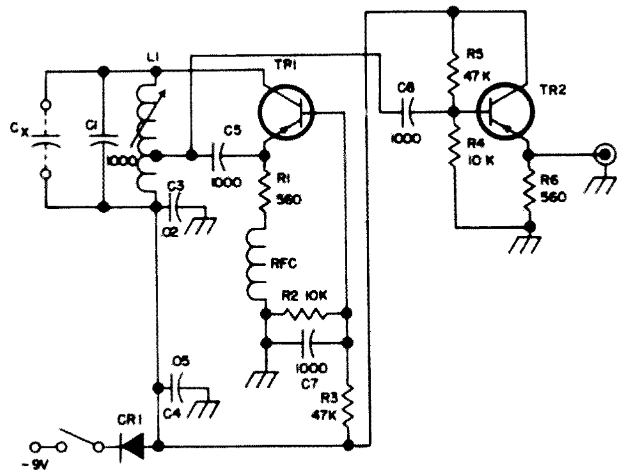
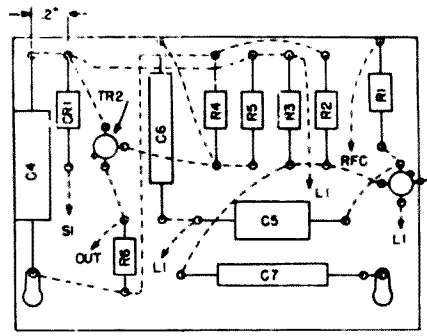
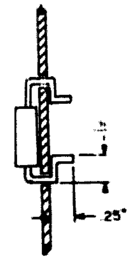


Fig. 3. Schematic. TR1,TR2: 2N964, HEP1; RFC: 2.5 MH National R100S; L1: 3/8" dia. slug tuned form, J.W.Miller 4400, 12 turns closewound No. 26E, tap 3 turns from the bottom; CR1: 1N34 type germanium diode; C1: 1000 pF precision capacitor (see text); C5: 1000 pF mica; other capacitors can be ceramic or paper. All resistors 1/2W, 10%.



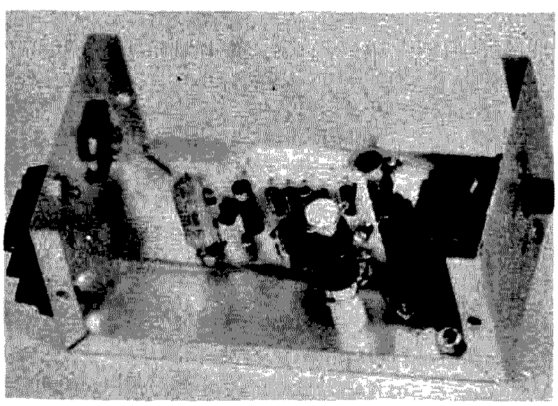


Method of crimping component lead.

Fig. 4. Component board. Component side solid, wiring side dotted lines.

output of TR2 from affecting the oscillator frequency. CR1 is a safety diode that prevents the application of reversed voltage from causing any damage. The circuit is conventional in all other aspects.

The complete unit is built into a 5" x 3" x 2" minibox with plenty of space to spare. All components except L1, RFC, C2, C1 and the on-off switch are mounted on a 2-1/4" x 1-7/8" piece of 85G24EP Vectorboard (holes on .1 inch centers staggered) and held onto the chassis by spade lugs. A layout of the board is shown in Fig. 4. The components are mounted by inserting the leads through the holes and crimping them as shown in Fig. 4. Although the components can wiggle when first installed, the board becomes one solid mass after wiring. Wiring is done on the back side of the board in conventional fashion. It is recommended that construction similar to that shown be followed in order to minimize the effect of stray capacitances on accuracy. 1% of 1000 pF is 10 pF which means that the *rf* wiring must be short, direct and kept away from ground. For this latter reason, the hot end of L1 and C1 must be isolated from ground. This is accomplished by mounting the binding posts on a 2-1/8" x 1-5/8" piece of phenolic and inserting behind a 1-13/16" x 1-1/16" cutout on the top front of the aluminum box as shown in the photograph. The terminals are mounted 13/16" apart to conveniently accept the leads of the capacitor to be measured.



Inside view of device.

C3, the .02 disc ceramic bypass capacitor, mounts between the bottom end of L1 and the spade lug ground. TR2 output feeds to a phono type jack. Although there is sufficient space to include a 9v battery inside the box, I decided to bring power in through a terminal strip instead. The chances are that the CMBFS unit will receive occasional use and that the battery will be dead when you do want to use it. I thought it best to use an external power supply or a battery borrowed from a transistor radio BC set when needed.

Operation

Apply voltage to the CMBFS unit. Tune your receiver to 4000 kHz. Connect the output lead to the receiver antenna terminal. Tune L1 until the signal from the oscillator is zero beat with the receiver. It should be a

well over S9 stable signal. Now connect the capacitor to be measured to the binding posts. You will note that the signal is no longer at 4000 kHz. Tune your receiver lower in frequency until the new signal is picked up and zero beated. If there is any question about it being the correct signal, bring your finger near the hot binding post and the frequency will shift slightly. Record the new frequency and subtract it from 4000 kHz to get the shift (Δf) in frequency. Now read the actual value of the capacitor corresponding to Δf directly from the chart **(Fig. 2)**. That's about all there is to it.

It may not be necessary to actually connect the CMBFS unit output to the receiver antenna terminal. Radiation from a 2 or 3 foot piece of wire may be sufficient, depending upon the shielding of the receiver. More important is the elimination or reduction of 80 meter signals from other amateur stations that tend to confuse or lose the CMBFS signal. Disconnecting the 80M receiving antenna is desirable. I have found that switching to the 10 or 15 meter antenna or the dummy load is quite effective in reducing extraneous 80M signals.

The battery voltage isn't critical. A 1 volt shift from -9 to -8 volts causes a barely discernible several cycles shift in frequency. Although the oscillator will oscillate down to 2 volts, I don't recommend operating at this point because the loading factor K1 will noticeably increase and cause an inaccuracy in the measurement.

Summary

Equations – equations, the proof is in the performance! A number of capacitors were selected from the junk box, measured by this technique and compared to the ¼% precision laboratory bridge. The receiver measurements were made with my old Collins 75A1 and repeated with a Drake TR3 transceiver. The results were as follows.

Face Value	CMBFS Value	Precision Bridge Value
10 pF	10.35 pF	10.45 pF
50 pF	50.8 pF	51.6 pF
100 pF	115.2 pF	115.0 pF
180 pF	175.0 pF	174.6 pF
270 pF	269.36 pF	268.4 pF

Not bad, considering that the CMBFS unit costs less than $10 while the precision bridge costs over $1,000.

Although this particular unit has a capacitance range up to 313 pF, there is no reason why a higher C1/L ratio can't be chosen to permit reading higher values of capacitance, that is, if you have a computer handy to give you a new set of computations. Another approach for extending the range is to keep C1 at 1000 pF, but split it into two parts with the unknown capacitor placed across one of the parts in a capacitive divider arrangement. This again requires recomputation. The present range satisfied the majority of my requirements in working with *rf* circuits and provided the excellent definition of .5 pF/kHz at the low end and .75 pF/kHz at the high end of the range. Thus this approach, coupled with the computer printout rather than the usual plotted curve, permits measuring a fraction of a pF difference between 300 pF capacitors.

CMBFS isn't a technique for the production line testing of capacitors but it is well suited for the occasional amateur need and is capable of providing a high degree of accuracy at low cost.

APPENDIX I

$$f1^2 = \frac{1}{4\pi^2 LC1} \qquad L = \frac{1}{4\pi^2 f1^2 C1}$$

with Cx in parallel with C1

$$f2^2 = \frac{1}{4\pi^2 L(C1 + Cx)} \qquad L = \frac{1}{4\pi^2 f2^2 (C1 + Cx)}$$

L is the same in both cases and can be equated

$$f1^2 C1 = f2^2 (C1 + Cx)$$

$$\frac{f1^2 C1}{f2^2} = C1 + Cx$$

$$\left(\frac{f1^2 C1}{f2^2} - C1\right) = Cx$$

$$\left(\frac{f1^2}{f2^2} - 1\right) C1 = Cx$$

$f2 = f1 - \Delta f$ where Δf = difference in frequency

$$\left(\frac{f1^2}{(f1 - \Delta f)^2} - 1\right) C1 = Cx$$

$$\left(\frac{f1^2}{f1^2 - 2\Delta f f1 + \Delta f^2} - 1\right) C1 = Cx$$

$$\left(\frac{1}{1 - 2\Delta f/f1 + \Delta f^2/f1^2} - 1\right) C1 = Cx$$

. . .W3HTF

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ADAPTING ELECTRONIC KEYERS TO OLDER TRANSMITTERS

It all began when a kind good ham friend donated an older type, cathode-keyed transmitter for use at my summer QTH.

It was a Harvey-Wells T-90; immediately appealing for its compactness and lightweight as compared to my burdensome HT-32 when it comes to lugging it back and forth. I eagerly checked out the T-90, bringing it up to specs and found out, rather quickly, that I wouldn't be able to use my electronic keyer (Heath HD-10) with it. The T-90, like any of the older transmitters, calls for grounding the cathodes of the oscillator and/or amplifier tubes for keying. The keyer output transistor will not switch cathode type keying and an attempt to do so can ruin the keyer with too high current.

Operation of the keyer is designed for low negative current as with grid-block keying; this, then, is safely switched through the keyer's output transistor.

Researching the transmitter project indicated an extensive rewiring would be required and a source of large negative voltage necessary to bias the keyed tubes to cut off.

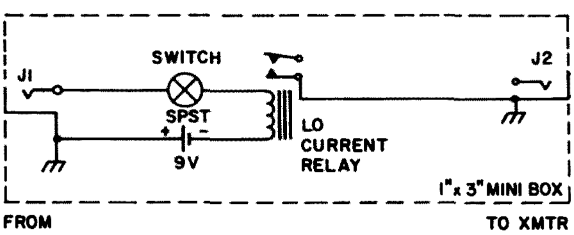
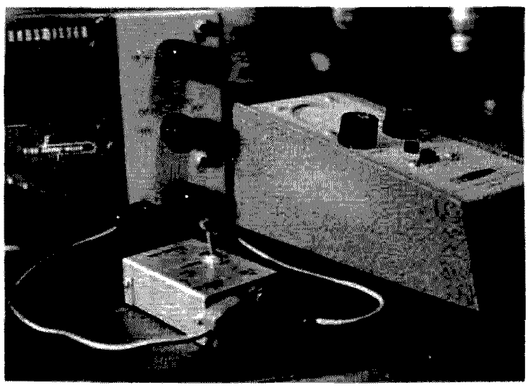


Fig. 1. Schematic diagram for match-key.



Rather than change the original design by rewiring and building an external supply, it occurred to me that a very simple and inexpensive solution might be applied. That is, a sort of interface unit that would satisfy both the keyer and the transmitter with the entire unit built into a "cigarette package size" including its power supply.

The electronic keyer requires that no spike voltages exceed 105 volts and that the circuit current be within 35 mA, otherwise the keyer output transistor will be damaged.

The MATCH-KEY unit constructed here is well within the requirements, running at 9 volts at 5 mA. To operate the unit, merely plug the keyer into J1 and a patch cord between J2 and the transmitter key jack.

The switch is optional and the battery should last indefinitely at a 5 mA drain. The combination of the MATCH-KEY and keyer have been used very successfully at slow or high speeds.

...W1JSS

GONSET LINEAR MODIFICATION

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For those of you who want a good linear at reasonable cost – read on. You will do well to investigate the older models of the Gonset 201 linear amplifier. Not that the new models are not good; but the older models can be had at quite a reduced price.

The main objection to the older models is the action required for the keying of the change-over relay. They were made to be compatible with the Gonset exciter and are not compatible with some of the other types of exciters.

In the case of the Gonset exciter they furnished keyed 115V ac for the change-over relay, while in other exciters this operation is accomplished by furnishing keyed ground. Although that is reason enough for some not to buy the unit, I hold that it does not constitute sufficient reason to reject a fine piece of equipment.

The modification is simple and easy to perform and will not detract from the appearance or the resale of the unit.

The only additional equipment required will be a small plate filament transformer with 125V secondary. Such a transformer is the Stancor PS-8415. The main requirement is that it be small enough to fit under the chassis of the linear. Also needed is the connection jack or terminal to which the control lead is to be connected. The unit used in my modification was the Motorola type or Switchcraft type 3501FP, requiring only a quarter-inch hole to be drilled alongside PL-5 outlet on the rear apron.

The best way for the modification to proceed is to understand what is desired and what is accomplished by the modification: We have a relay in the unit that is looking for dc for operation. We already have this supplied through the rectifier filter network originally installed in the unit. Where this network is looking for ac input, we will supply it with the transformer we are going to install under the output tank coil part of the chassis, as this is the area with the greatest amount of unused space. The mounting of the transformer can be left to your discretion. Suffice it to say, remember the cover has to go on again!

The secondary of the transformer – the 125V side – is to be wired to TS-1 on the linear (in other words, to the underside of the fitting where the cheater-cord formerly plugged in). This socket will now become a terminal strip for connecting purpose only. The primary or 115V side can now be connected to the switched side of the ac line incoming to the unit. The most likely place would be where the fan motor connects to the line. Thus we have the supply connected, and the relay will operate.

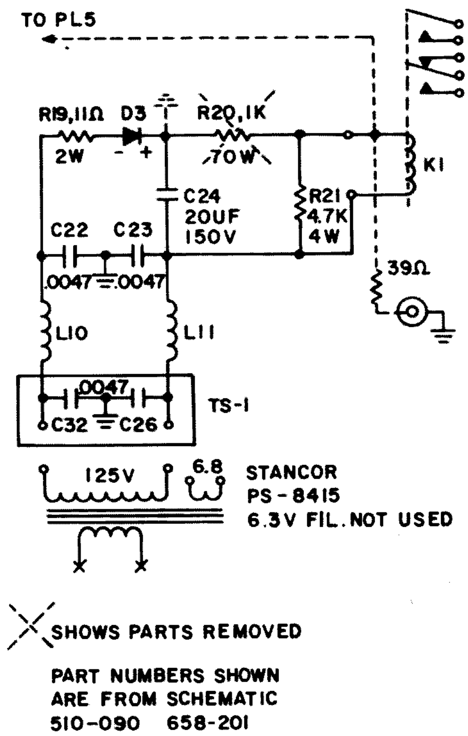

Fig. 1.

But let's pause a moment and reflect. We now have 100V dc to operate the relay. The manual states that minus 100V is needed to cut the amplifier off during receiving periods. So let's use this minus 100V to do just that. By grounding the junction of C24, D3 and R20 – this being the positive side of D3 – it will ground the positive side of the supply, leaving us the negative side through the relay and load resistor R21 to run to PL5 where the external bias was to be applied.

Since we now have minus 100V, it would be wise to remove or replace C1 in the grid lead, as this is a 25V condenser and will not be needed, as is the case of D1 diode which formerly supplied the minus 4V of bias. Also remove R20, as we will no longer need this resistor.

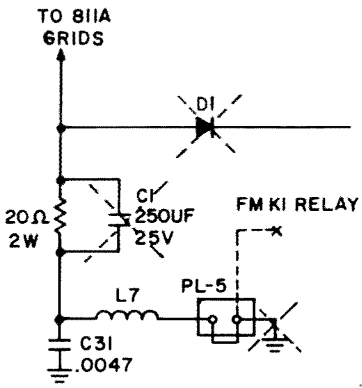

Fig. 2.

When connecting PL5 to the supply for K1 relay, be sure the voltage goes through the winding of K1 relay, as this is quite important.

While the amount of current passing through this winding will not operate the relay, it will be enough to bias the grids to cutoff.

To operate the relay with the ground supplied from the exciter, it will be only necessary to ground the grid side of the relay for operation, thus cutting off the bias to the final tubes and operating the change-over relay.

This modification may be applied to several types of linear amplifiers with equal success. The result is a smooth operating unit of equipment with built-in ruggedness.

. . .W6HGX

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A TIME FOR EVERYTHING

Time and tide wait for no man." So runs an old English proverb attributed to Chaucer in the 14th century. As far as time is concerned, this is not surprising – with time moving at the speed of electrons in space, man is ruled by time! Time has influenced all of the actions of mankind since the beginning, when the caveman no doubt planned his life around the rising and setting of the sun. Wars have been won and lost because of time, or the lack of it; and in their everyday actions man and animals base their every move upon time.

Because the time of day varies throughout the world, the zonal time computer that is included in this article can prove valuable to anyone who has occasion to know the time at any point on the earth's surface with respect to his own position.

The map drawn on the face of the computer is known as a "modified polar azimuthal projection." This map presents a view as if you were stationed in space above the North Pole, looking down, but somehow you can view beneath the equatorial line. A map such as this becomes highly distorted when viewed this way, but the shape of the continents, especially in the Northern hemisphere is quite clear. The computer and its operation will be described more fully later, but first, let us examine some interesting background relating to time.

Man probably advanced his timekeeping ability by watching the changing position of shadows cast by trees and other objects as the day progressed. There is evidence to suggest that in very early times, by very complex calculations the priests of Stone-

henge (England) were able to increase their power over their people by recognizing that the sun cast the same shadow at the same time in a certain position each year – thus they were able to forecast the occurrence of certain natural phenomena, such as an eclipse.

Later came the sundial, burning candles that had markers on them for keeping time, and finally watches and clocks. The invention of the latter instruments, about 1700, made the use of apparent solar time less than satisfactory, because apparent solar time, which is the time as measured by a cast shadow from the sun, varies east and west of any given point at any moment. In fact, this variance amounts to four minutes for every degree of longitude. So, for a watch to be strictly accurate it would need to be set ahead or back for each degree!

Until quite recently, time measured in minutes and hours was quite sufficient for daily accuracy; and indeed, this is still usually enough for one's purpose. However, advances in all of the sciences, particularly electronics, now require extremely minute measurements or actions to occur in the electronic computer, where functions are measured in picoseconds (one million-millionth of a second!), for such purposes as propagation delays in integrated logic circuits.

Although the methods of measuring time have varied, the measurement is always based upon some recurring phenomenon; the *apparent* motion of the sun around the earth being the most common observation. Time measurement based on this observation is known as *mean solar time*. Time measured by observing the earth's movement in respect to the fixed stars is known as *sidereal* time. You will notice that we emphasized the word "apparent." Obviously, although it appears to us, and it did to ancient man, that the sun and stars are moving across the sky and we are standing still, the motion is actually due to the rotation of the earth upon its axis.

Mean solar time, until 1956, was the scale upon which the arbitrarily selected unit of time – the second – was based. However, because the speed of rotation of the earth is not constant, corrections to solar time are constantly necessary. Due to this, the mean solar second was replaced with "ephemeris" time as the fundamental unit of time interval. Ephemeris time is also determined by astronomical observations of the stars other than the sun.

Nevertheless, mean solar time continues to form the basis for providing time zones around the earth. The circumference of the earth is divided into 360 degrees, and a fixed point on the earth will turn through these 360 degrees in 24 hours. The instant when the sun comes over an observer depends upon his position on the earth – his longitude. Because of the difficulty mentioned previously, that was encountered when watches were first introduced, an hour of time was arbitrarily assigned to an area by local custom. This created another problem which was serious enough while travel was still relatively slow, by foot and by horse and carriage, but with the coming of steam trains the situation became chaotic. Sometimes, a person traveling east and west (or even south and north!) would pass through three different times-of-day in traveling but 50 miles, because of local time differences that were selected by the various towns and villages.

Standard Time

Primarily, because of the railroad, but also because of this general confusion, "Standard" time was adopted by most of the nations of the day at a conference held in Washington, D.C. in 1884. Standard time, as defined, was to be based on the mean solar day as reckoned by the Royal Observatory, England, and the meridian of longitude at Greenwich, England was accepted as the prime (zero) meridian. This meridian had existed, of course, for centuries but was not acknowledged by every nation as being the prime meridian. At the conference there was a great deal of debate deciding where the prime meridian would, in fact, be located. The meridians of Jerusalem and Rome were advocated for religious reasons; the one passing through the Great Pyramid at El Gizeh was suggested due to the survival of this landmark for centuries; and even one passing through

Hierro in the Canary Islands was recommended because of its location on important sea lanes. Once the decision was reached to designate the meridian at Greenwich, an instrument known as the "Airy transit circle" installed there comprised the primary reference. This device is still at this location, maintained as part of a national museum. By agreement at the conference, the central crosshair of this instrument designates the fundamental reference point for determining longitude. Although the Royal Observatory was moved in 1948 from Greenwich to Herstmonceux Castle in Sussex, no change was made to the prime meridian reference point location.

Having established the zero reference point, the method for calculating the hour of the solar day was determined. The earth's 360-degree circumference is divided into 24 time belts, or zones, of 15 degrees each, with each zone differing in time from Greenwich by an integral number of hours. The center of each zone is on one of the meridians, with the zone itself extending 7½ degrees on each side of the meridian. Interestingly enough, the standards as established at this conference were not ratified by the United States government until March 19, 1918. Although commerce, and the railroads particularly, set their own time zones, usually at divisional points, time from place to place varied widely until this ratification occurred. Today, in the U.S., time zones are established by the Interstate Commerce Commission.

The zones along the meridians are not always exactly parallel. Political boundaries of the various countries and states have caused some modification, so that although the sea and in the air a zone will parallel a meridian, a time zone on land may zig-zag considerably. For instance, in traveling in a straight line north and south in Russia, one may have to change his watch three times between its southern border and the Arctic ocean.

Other countries and places, although having time differences from Greenwich that are fairly close to the nearest meridian zone, have fractional hourly changes. For instance, the Tonga island group, at 175° west longitude in the Pacific, has a time difference from Greenwich of minus 12 hours and 19 minutes; the Cook islands, also in the Pacific, have a difference of minus 10 hours and 38 minutes. A great many places have half-hour differences from the zone hour, as India, with minus 5 hours and 30 minutes from the Greenwich meridian.

International Date Line

At some point on the earth's surface a new day must begin for the purpose of determining time. The position for this was arbitrarily adopted by seafarers many years ago, as a place convenient to them but not inconvenient to any populous area. This position was the 180th meridian east and west of Greenwich. (For navigational purposes, the earth's 360 degrees is made up of 180 degrees east, and 180 degrees west, of Greenwich prime or zero meridian.) The International Date Line diverts from the 180th meridian in several places to avoid large land or populated areas, notably the East Cape of the USSR, The Aleutians, and the Fiji island area of the South Pacific. When crossing this line traveling west, one full day is "lost," and when crossing east, a day is "gained." That is, on the east side of the line it may be 0900 on Tuesday, but immediately on the other side although it is also 0900, it is Wednesday. It may be considered the point where the "new day" begins, and, of course, in determining time differences between zones, this day difference must be considered. The International Date Line is not officially recognized by any world agreement at the present time, but is, nevertheless, accepted.

International Use of Time

The mean solar time of the Greenwich meridian is used for many commercial, scientific, and technical purposes to avoid problems that would occur by attempting to use conflicting local times. The official name that has been adopted is Universal Time, abbreviated UT, but frequently by long custom it is designated GMT (for Greenwich Mean Time). It is also known as "Z" (Zulu) Time, especially in the military services. The latter designation is also arrived at by international agreement, as is

the arrangement of all of the other lettered zones described below. Times recorded in the successive 15 degree zones east of Zone Z are designated by the suffixes A through L (omitting J). Time in the eastern half of the zone over the Date Line is suffixed M. Westward from Z zone, the time suffixes are N through X. The letter Y is applied to time in the western half of the date line.

Many other time zones are established locally. Western Europe is on Central European Time (−1 hour, or ahead of Greenwich or Z time), the British Isles and Portugal also recently changed to this time, previously having been on Z time. Mexico, for the most part, follows the same time as United States Central Time (+6 difference from Greenwich), although most of that country is over the 105° W. longitude meridian (+7 hours). Newfoundland and Labrador are 3½ hours (+3.30) behind Z time. New Brunswick, Nova Scotia, and Eastern Quebec are on Atlantic Time, and although Alaska is 10 hours behind GMT, four time zones are actually in use in that state.

For these reasons it has not been possible to show all of the many time zone variances on the map on our computer. In general, the time zone which lies over a country or continent will be correct for that place. However, for specific places, the Index of Locations should be consulted. A few spaces are provided to allow you to enter any places that may not be included and to which you may wish to refer frequently.

The 24-hour Clock

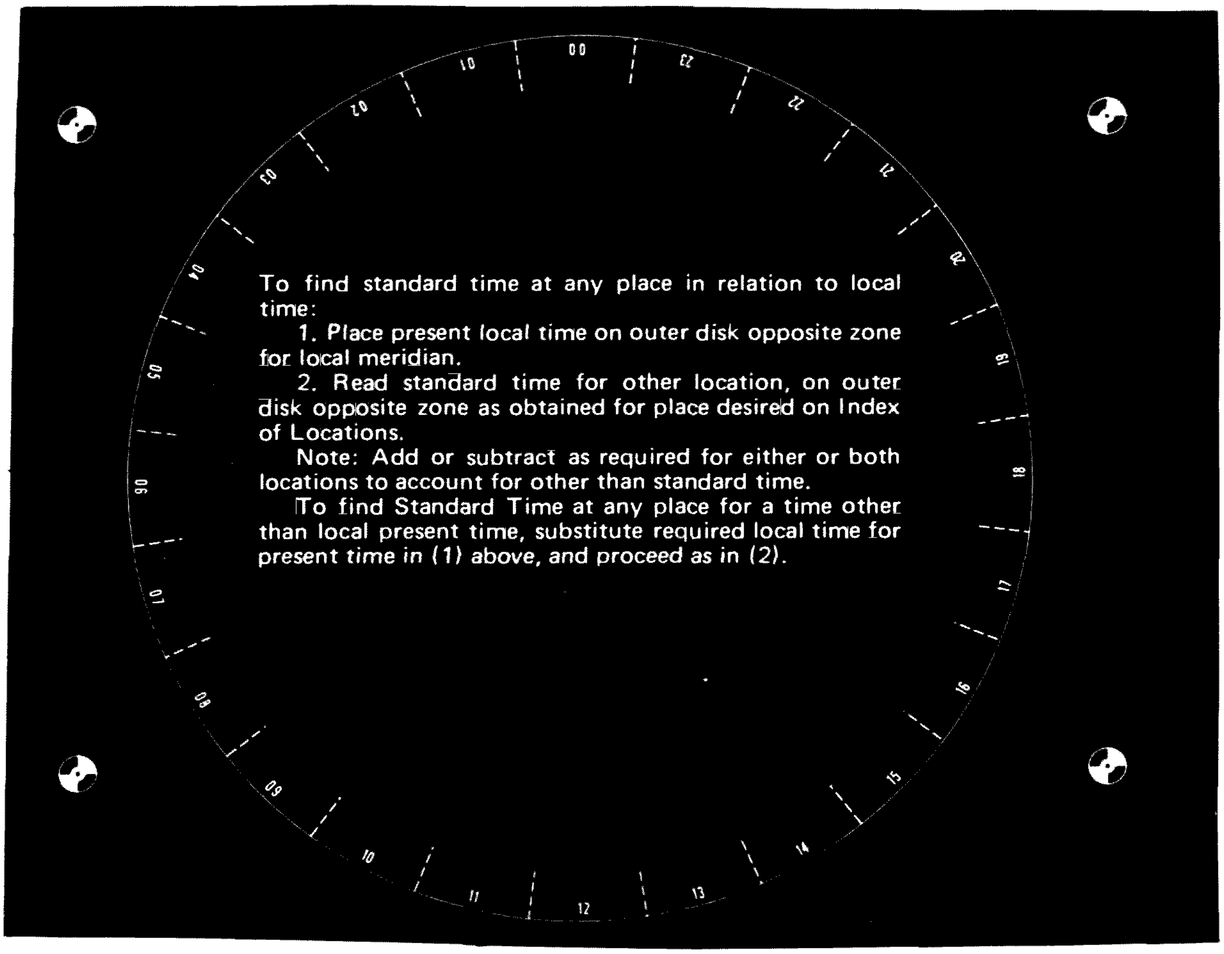
In civil use in the United States and some other countries it is customary to assign a.m. as a suffix to the hours from midnight to noon, and to indicate from noon to midnight by using p.m. There is always the possibility of omitting either suffix, or of erroneously showing noon as either 12 a.m. or midnight as 12 p.m. Such ambiguity is avoided by using a 24-hour system and assigning 24-hour designations to a 12-hour clock, not necessarily on the face of the clock, but by remembering where the differences occur.

You will have noticed that virtually all radio schedules are in the 24-hour system. The hours from midnight to noon are indicated as 0000 to 1200 to the first two digits of the hour two more digits are added to indicate the minutes. The hours from 12 noon until one minute before midnight are referred to as 1200 to 2359. The word "hours" is not added after the four digits. The 24-hour day system, beginning at midnight GMT, was accepted as a standard by world governments on January 1, 1925. On our computer no minutes have been shown, as these will vary according to the moment of use. Unless the place for which the time is being calculated is on a fractional part of an hour difference, the minutes will always be the same at both your location and the other place.

Time Signals

In an international society there are many phenomena that depend on exact timing and uniform recognition of time. Tide timetables for ships, for instance, must all speak the same time "language" to mean the same for all nationalities. Communications and transportation must also have uniformity in their designation of time. In addition to recognizing a universal system, therefore, the broadcasting of time signals for the accurate adjustment of chronometers for these services must be based upon a standard, and this standard has been accepted as GMT.

Many radio stations transmit time signals for these purposes. Accuracy, to an atomic clock primary standard (wherein time is synchronized to the frequency of oscillation of electrons in certain substances), remains constant over a year to about one part in 10^{10}. Navigational Loran time pulses of the United States Coast Guard are accurate to one microsecond. Details of the transmission of time signals throughout the world are usually available from the government agency controlling telecommunications for the various countries. In the United States and Canada, the most recognized stations are WWV, National Bureau of Standards at Fort Collins, Colorado, transmitting on 2.5, 5.0, 10.0, 20.0, and 25.0 MHz; and CHU, the Dominion Observatory, Canada, transmitting on 3.33, 7.335, and 14.67 MHz.



Assembling the Computer

Cut out the two circles carefully, keeping the cut to just expose the edge line. Paste the circles to any heavy card stock cut to the same dimensions. Using a small pin, make a small hole in the center of each piece, where the dot indicates the center. Place the smaller circle directly over the larger, then fasten them with a small eyelet positioned exactly in the center. If the holes are not exactly centered, the time zones will not align properly. Eyelets may be obtained at most notion counters of five-and-dime or department stores. One package, known as "E-Z No. 720," contains 25 eyelets together with a tool for making the hole, and another for crimping the eyelet, all for 29¢. This package is manufactured by E-Z Buckle, Inc. of New York, N.Y. A snap-fastener, also available in notions departments, may also be used, but may not allow the disks to turn as smoothly. As a last resort a small screw, flat washers, and a nut may be used.

Using the Computer

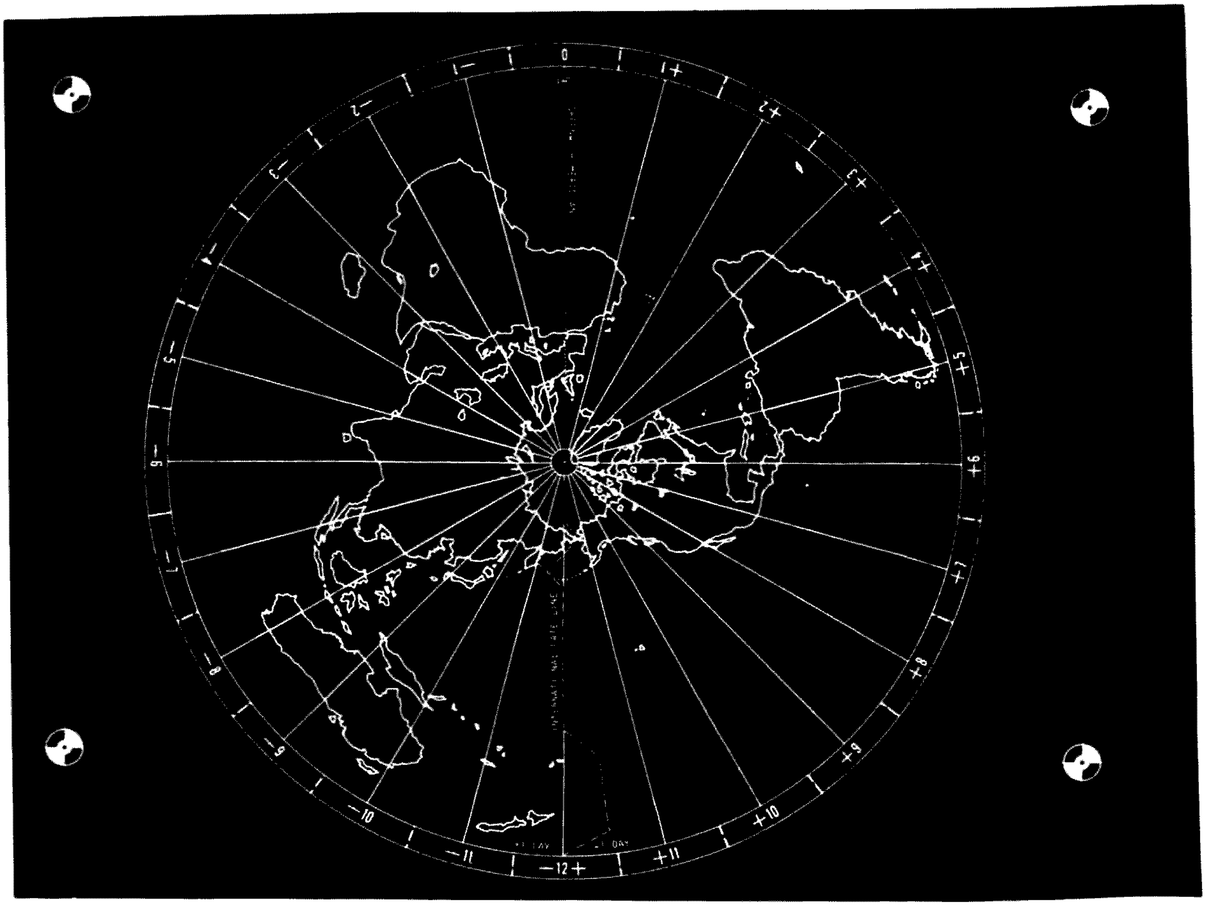
Using the computer is extremely simple. Directions for its use are printed on the lower disk. Just remember to always consider that if the location for which you are calculating the time is west of the International Date Line and you are east of it, it is "tomorrow" there; and "yesterday" if you are located west of the line and the time you are seeking is east of the line.

The positive and negative hours shown on the outer perimeter of the top disk actually represent the time difference in hours from Greenwich Mean Time at a particular meridian. This time difference would be true at any location where political boundaries or local laws are not applicable; for instance, at sea, or where no legal time has been established (parts of Greenland, for example). On the computer the positive and negative hours guide the user to the correct zone as referenced in the Index of Locations.

To find standard time at any place in relation to local time:

1. Place present local time on outer disk opposite zone for local meridian.

2. Read standard time for other loca-



tion, on outer disk opposite zone as obtained for place desired on Index of Locations.

Note: Add or subtract as required for either or both locations to account for other than standard time.

To find Standard Time at any place for a time other than local present time, substitute required local time for present time in (1) above, and proceed as in (2).

Index of Locations

List of places with zones to be used as they appear on front of computer. Where entire or nearly entire country is in one zone, cities within that country are not listed.

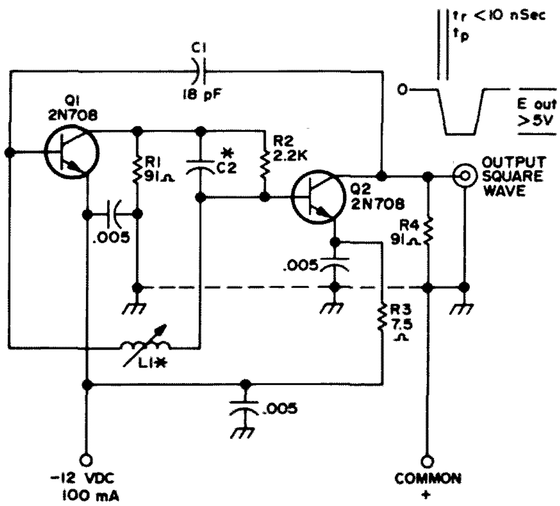
Afghanistan	−4½
Australia – Perth	−8
– Sydney	−10
Alaska – Anchorage	+10
– Juneau	+8
– Nome	+11
Argentina	+4
Bolivia	+4
Brazil	+3
Chile	+4
China	−8
Colombia	+5
Cuba	+5
Ecuador	+5
Ethiopia	−3
Europe	−1
Finland	−2
Formosa	−8
Greece	+2, +3, +4
Guatemala	+6
Haiti	+5
Hawaii	+10
Honduras	+6
Hong Kong	−8
Iceland	+1
India	−5½
Iran	−3½
Israel	−2
Jamaica	+5
Japan	−9
Kiev, USSR	−3
Korea	−9
Latvia	−3
Moscow, USSR	−3
New Zealand	−12
Nicaragua	+6
Paraguay	+4
Peru	+5
Phillipines	−8
Puerto Rico	+4
Rangoon Burma	−5½
Singapore	−7½
South Africa	−2
Surabaja Java	−7
Syria	−2
Thailand	−7
Turkey	−2
United Arab. Rep.	−2
Uruguay	+3
Venezuela	+4
Viet Nam	−8
Vladivostok, USSR	−10

. . . WB6KFI

CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



SQUARE WAVE SOURCE

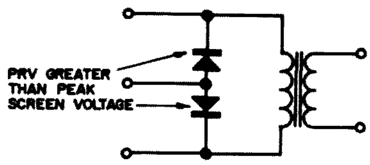
Trim L1 for best waveshape. An overtone crystal (odd order) can be substituted for C1. For 51 ohm output change R1 and R4, reduce supply to 8 volts. Heat sinks suggested on Q1 and Q2. When cutting and tying, reduce input to about 6 volts.

All resistors are ½W carbon. Capacitors in decimal are disc type (short leads). 2N708's for best performance are Fairchild (other brands work, but do not give clean waveshape).

Harmonics observed into microwave region. Symmetrical square wave at output; dc reference to ground. Output at 4 MPS ≈ .5 watt. Short circuit protected.

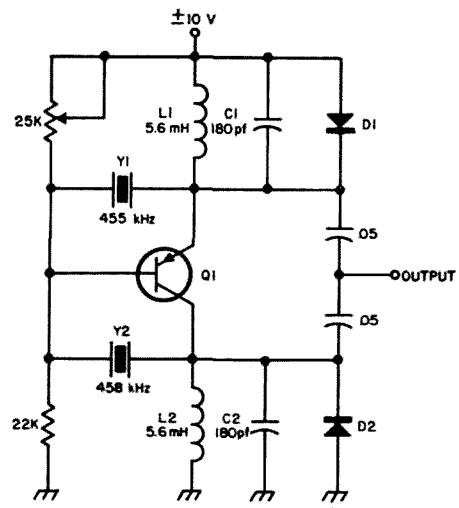
	Typical Values	
MPS	C2 pF	L1
4.0	100	82 µH
10.0	47	15
15.0	47	10
20.0	47	4.7
30.0	47	2.2
50.0	47	2.2
72.0	39	.22

Thanks to W8MPB.



Diode center tap for use with modulation transformers that have no center tap. This circuit was originally designed to modulate a tetrode balanced modulator. Audio is injected into the single end.

K5LL1



This two frequency crystal oscillator changes frequency by simply reversing the supply voltage. When the supply voltage is changed, the transistor inverts itself; usually transistors may not be used in the inverted mode, but in an oscillator a gain of only 1 or 2 is needed and this circuit provides a novel and simple way of obtaining two frequencies from a single stage with a minimum of switching. Almost any PNP rf transistor will work as Q1. D1 & 2 are general purpose silicon diodes. From 73 Useful Transistor Circuits, available for $1 from 73.

Continued on page 143...

Gene Brizendine W4ATE
600 Hummingbird Drive SE
Huntsville AL 35803

PROTECTION FOR ICs

This IC-saving circuit is so simple it may appear too obvious to suggest. However, should a regulated power supply pass transistor short-circuit, $100 worth of IC's may easily be destroyed by excessive voltage, for example. The cost of new IC's, plus the often tedious task of troubleshooting and replacement, emphasizes the need for such positive protection.

Essentially, a selected zener diode is wired internally across the regulated power supply output. A typical application for protecting the popular 7400 TTL IC series is outlined in Fig. 1. This particular IC family has a power supply span of negative 0 volts to a positive 7 volts. The device design supply voltage is 5.5 volts, therefore during normal power supply operation the protective circuit draws little current.

With abnormal supply voltage, due to defective regulation or any other cause, the excessive voltage is dissipated in R and the zener diode. The load devices are protected because the applied voltage cannot exceed 7.25 volts. The power supply transformer and rectifier are protected by the combined dissipations of R and CR.

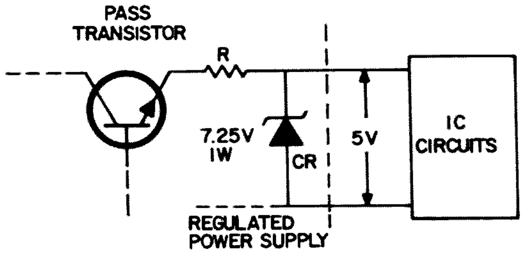
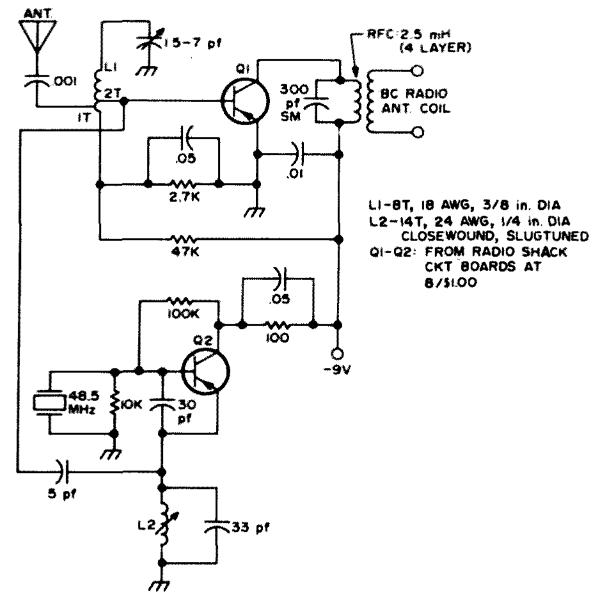


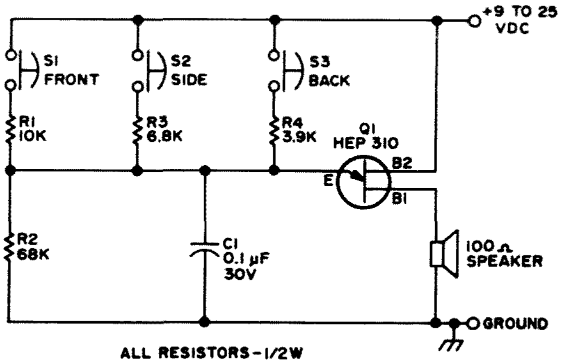
Fig. 1. IC protective circuit.

The exact values of R and CR are dependent upon load and power supply characteristics and are easily determined. The cost of a selected zener and resistor is insignificant, compared to the expensive devices they may save.

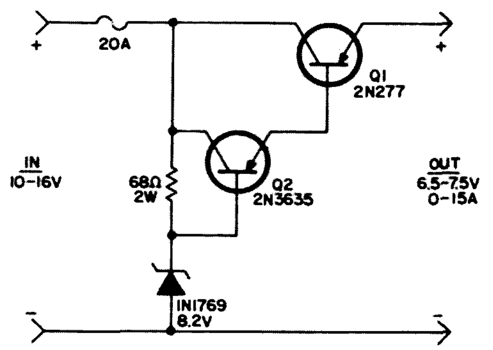
. . .W4ATE



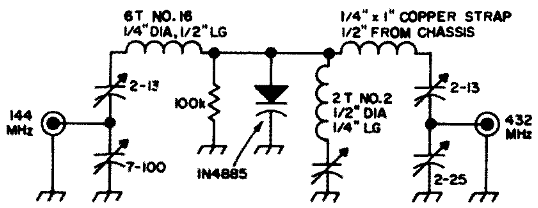
Here is a circuit of a simple 2m converter that works in a pocket AM radio. Since it is crystal controlled, the receiver must tune to a frequency that equals the desired frequency minus 3 x 48.5. Substitute a different frequency crystal if a strong BC station happens to heterodyne with the desired 2m signal. *K5IZH*



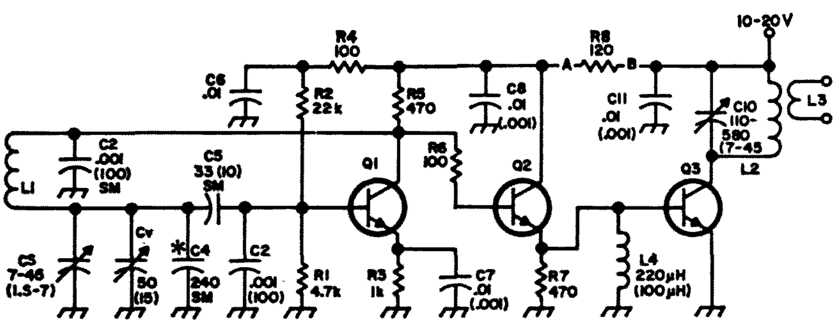
Electronic door buzzer. This circuit features a different tone for each door. The tones may be varied by experimenting with different resistors at each switch. Courtesy of Motorola Construction Projects HMA 37.



6V supply from a 12V source. This is a handy device to use in case your surplus FM rig happens to require 6V. A 2N2147, 2N4314, or 2N3616 can be used in place of the 2N3635 at Q2. Be sure to use a large heat sink for the 2N277 power transistor. *K3GSY*



144 to 432 MHz varactor tripler that will give 17W output at 432 when driven by a 25W 2m signal. From the Diode Circuits Handbook, available for $1 from 73



TO COLLECTOR-MODULATE FINAL:
OMIT R8
APPLY MODULATED VOLTAGE AT B
APPLY 9 TO 10V AT A

*C4 NOT USED IN 6M VERSION

COIL DATA

COIL	80M	6M
L1	35T NO. 22 ON T68-2 CORE	9T NO. 22 ON T50-10 CORE
L2	SAME AS L1	SAME AS L1
L3	3 TO 4T NO. 22 ON COLD END OF L2	SAME AS 80M

Here is a stable VFO that can be assembled in a short time on a piece of Vectorboard. Coil data is supplied for an 80m and 6m version but other bands may be covered with a bit of experimentation. Transistors are all MPS706 but higher output is possible by replacing Q3 with a 2N2270 or 2N3053.

TECHNICAL AID GROUP

The Technical Aid Group is a group of hams who have indicated a willingness to share their knowledge and skills with others. They have volunteered to be of service to fellow hams and do so without compensation. If you have a technical question, look over the list to see who has competency in the area of your question. For many of the TAG members, descriptions of all areas of expertise would be lengthy, so an abbreviated description is given. When stating your problem, give as much information as possible and clearly state the difficulty. Enclose a SASE for reply.

For those hams who have a desire to share, the TAG is the thing for you. Send a brief note requesting the membership form, fill it in and send it back. It asks a few questions about your qualifications, and there is a check-list to indicate your fields of competence. These cover all modes currently used by hams, antenna design and theory, transmitter and receiver design for HF, VHF, and UHF, logic, ICs, general help, and other areas. As more members are added, their names and addresses will be published.

This list is not complete, but represents those former TAG members who have responded to a recent mailing and have expressed a desire to continue in the program. Comments from them indicate that they have enjoyed helping and all have been contacted frequently for advice.

Robert Perlman WB2VRW, 3 Josten Place, Hudson NY 12534. Electrical engineering student. Will help with Novice transmitters and receivers, and any help for beginning hams.

Thomas Laffin W1FJE, Box 133, Hillsboro NH 03244. Radio communications technician. Special aid to ex-CBers and those who need terms in easily understood terms; aid to Novices and Techs interested in MARS, RACES, CD, and CAP; how to build and scrounge parts; assistance on ham history, ATV, microwave, and general help.

Theodore Cohen W4UMF, 8603 Conover Pl., Alexandria VA 22308. Geophysicist. Specially prepared to answer questions about SSTV and ATV.

J. Bradley Flippin K6HPR, 116 Montecito Ave., Apt. M., Monterey CA 93940. Electronic engineer. Help with RTTY, data processing and programming, general.

Ira Kavaler WA2ZIR, P.O. Box 54, Flatbush Sta., Brooklyn NY 11226. Electrical engineer. Assistance offered in theoretical aspects of electricity and electronics from dc to UHF, design of equipment, computer programming, and signal circuit (failsafe) design.

Jon Teich WB2JAE, 22 Olden Rd., Edison NJ 08817. High school student. Novice and others, transmitter and receiver problems, logic, and general.

David Felt WB6ALF, P.O. Box 261, Sierra Madre CA 91024. Electronics engineer. Qualified help in logic, digital and analog design, solid state, AM and TV.

Robert Groh WA2CKY, 65 Roxborough Rd., Rochester NY 14619. Communications engineer. Bob can lend a hand in HF and VHF transmitter and receiver design as well as solid-state logic and digital techniques.

Carl Miller WA6ZHT, 334 Paragon Ave., Stockton CA 95207. Computer technician. Carl's specialty area is solid-state QRP.

George Daughters WB6AIG, 1560 Klamath Dr., Sunnyvale CA 94087. Research associate. HF transmitter and receiver, SSB, and solid state, are George's fields.

D. Hausman VE3BUE, 267 Northcrest Pl, Waterloo, Ontario, Canada. Student. Novice transmitter and receiver problems as well as logic, digital techniques and ICs.

Hugh Wells W6WTU, 1411 18th St., Manhattan Beach CA 90226. Electronics instructor. Hugh can help with AM, Novice problems, VHF-UHF receivers and converters, solid state, test equipment, FM and repeaters, and general help.

Charles Hill WA7LQO, 4005 Campbell St., Baker OR 97814. Student. TV, Novice transmitter problems, and logic.

John Perhay WAØDGW, Route 4, Owatonna MN 55060. EE technician. John will help with RTTY, AM, SSB, Novice gear, HF transmitters and receivers, solid state, ICs, and test equipment.

Jim Jindrick WA9QYC, 801 Florence Ave., Racine WI 53402. Consulting engineer. General help as well as HF, VHF, and UHF antennas, transmitters, and receivers.

William Welsh W6DDB, 2814 Empire Ave., Burbank CA 91504. Electronic engineer. Beginner's problems, code instruction, theory and regulations.

Ken Knecht K8VNT, Box 39, Clintondale NY 12515. Television engineer. TV, logic, and digital techniques.

Tom O'Hara W6ORG, 10253 E. Nadine St., Temple City CA 91780. Communications engineer. RTTY, TV, AM, SSB, VHF antennas, transmitters and receivers for HF through UHF, solid state, and general help.

Bruce Creighton WA5JVL, 2517 Metairie Ct., Metairie LA 70002. Electrical engineer. Antennas, Novice problems, solid state, logic, digital techniques, test equipment, and general help.

Tom Borok WB2PFY 215-33 23 Rd., Bayside NY 11360. Student. Tom is especially qualified to help Novices with their problems with transmitters and receivers, HF and VHF antennas, HF receivers, test equipment, and surplus, Morse code instruction.

Roger Taylor K9ALD, 2811 William St., Champaign IL 61820. Engineer. Roger is adept with AM, SSB, antennas, solid state, logic and digital techniques, ICs, test equipment, and other general help.

Orris Grefsheim WA6UYD, 1427 W. Park St., Lodi CA 95240. TV technician. Orris is capable of assisting in all fields of amateur work, DC through UHF, logic as well as Novice help.

John Allen K1FWF, 112 Edgemoor Lane, Ithaca NY 14850. Technical director. John's areas of assistance are VHF and UHF antennas, receivers, and transmitters, solid state and digital techniques, ICs, and SSB.

LETTERS

Letters continued from page 156

I have recently acquired an RT-176/PRC-10 RCVR/XTMR and I would like to know if you could tell me how to obtain a schematic diagram for the power and audio connections of this unit.

David W. Mackeil
75 West Main St.
Hopkinton MA 01748

One easy way is to write to the LETTERS column and hope that someone with the information will read your letter!

Just a couple of comments on your Editorial Page in the December issue. Namely – "FM – Friendliness Machine." You put it very well but I'm afraid that many FM'ers in the D.C. area will fail to get the point as they are of the opinion that the Repeater Trustee makes the rules, not the FCC.

We of the Capital Area Repeater System (CARS) welcome all amateurs and feel privileged when a newcomer cares to use our facilities. We go out of our way to talk with out-of-towners and to some, are known as WB4QFP, the Quite Friendly People. However, to one of the smaller Repeaters in the area (and I don't mean just in number) we are known as the Garbage Grinder.

It goes without saying that this smaller repeater will remain small until they realize that they are taking up the space, not the users.

Let your readers know that 31–91 and, soon to be, 22–82, are available any time they are in the Washington, D.C. area, and we can hardly wait to talk with them.

Don't forget our convention next September.

Don WB4QAX

I just finished the December issue, and I thought it was pretty good. To keep from getting barraged with any more of your "You'd better renew" cards I've sent along $6 for another year of 73, and my free book, of course! (Last year I purposely held out until the last minute before I renewed just so I could read all the different renewal cards that 73 sends. I must admit they are much better than the stuffy cards sent by QST.)

Anyway, I just wanted to say a few things about 73. First, I was wondering what happened to the newspages. Your columns do cover most of what's happening, but I still liked the newspages along with the columns. Also, I wish you would lengthen your editorials and talk about ARRL more than you do, so I know what's really going on.

What's wrong with a regular DX column? Lots of hams like to know what's going on DX-wise, but don't want to spend $12.00 more a year for just DX news.

Bob Davidson WB8IPB

That's what we asked ourselves . . . "What's wrong with a Regular DX column?" So now 73 has one.

Re: May 1971 "Transistorized LM Freq Meter" 73 Magazine, page 60

I have answered sufficient questions about the conversion to warrant a note in 73 Magazine.

TRANSISTOR SUBSTITUTES – Thanks to Bob Bloom W6YUY, the following can be made: MPF - 3004 VFO. MFE - 2095 MIXER. MPF - 107 (2N5486) or 2N4416 XTAL OSC. MFE - 1095 AUDIO. They are made by Motorola.

SCHEMATIC HAS TWO R-106's – My error. The cathode resistor in VFO is R-105. Text did not say shunt R-106 with a 6K resistor. Schematic does show it.

Some FETS IN XTAL OSC. circuit draw more current from battery than the MPF-107. This added drain from the battery can produce small frequency shift in VFO when Xtal is turned off–on. I recommend separate 9 volt battery for the VFO. This can connect to power socket pin 16 provided the filament pins of the 6A7 socket are jumpered 1 to 7. Then 9 volts will appear on pin 6 of the VFO tube socket. The bottom of R-104 can be disconnected and shifted over to his new source of isolated voltage.

LM ACCURACY – doesn't improve with the conversion. It is still the original 0.02% as specified in the manual. The drift, resetability and stability is at least as good as the tube version.

BC-221 – I have not converted a BC-221 mainly because I don't own one.

Charles Landahl W5SOT
Los Alamos NM

Just a quick note to let you know moounbounce gear is progressing nicely here at W9CGI. Tower house is done, 16-11 EL CushCrafts are together, have Drake receiver-converter lined up in case BC348 mod not done, SSB-CW-AM-FM transmitter runs, transverter in building stages, linear parts acquired, some chassis work done, digital beam steering done – checked out – being modified in some areas, rack being wired, putting insulation and electric heat in top floor now.

Nice opening here to Manitoba last weekend. Worked Len VE4QL and Andy VE4MA both 5-9+ both ways from 23:10 when I turned on rig to 23:45 GMT Sunday. Made it all Provinces for me at last, including a real nice CQZ (VE2) exposition year card for AM contact of a few years back from up on Hudson Bay.

Wayne, could you put this in your letters column for me? Desperately need info, schematic, and manual for Central Electronics 10B. This is rig for moonbounce with transverter and linear added. Seems to run fine but no manual. Will purchase manual reasonable fee, or offer small deposit and mail both ways (please send card or letter first) for manual I can xerox and return to owner. Would be great help to us and "Echo" amateur radio group would certainly be grateful. Know it was built in Chicago territory in 50's or 60's, 5-10W out 80-10M, plug in coils, VOX, xtal control, and this one has homebrew VFO that seems to work. Need manual & info to add metering, tuneup, etc. Many thanks.

Great article by K2OAW on Freq. Counter in May, July and Sept. issue. Like 3-part articles, but would like to see 3 months in a row. Thought the last one with board would never arrive. Caught all omissions before following issue.

Dave Brown W9CGI
Noblesville IN

We, too, want the multi-part articles run in sequence – but now and then the drafting screws things up and there we are.

KILL THE NOISE!

Antenna rotator control boxes are generally quite noisy; click-click-click, as they turn. Carefully place thin art foam sponge rubber inside the case as an acoustic absorber. Make sure it clears the moving parts. The loud click-click will now be reduced to a mere peck-peck.

Richard Mollentine WAØKKC
Overland Park KS

A simple three letter word sums up the November issue.

WOW!

Richard J. Molby GS9E
APO NYC

As a direct subscriber to 73 magazine I read about what is happening on your side of the pond with interest. I was partiuclarly interested to note that dissatisfied personnel have the same manners and integrity over there as they do in the U.K. (see last paragraph of your editorial, September issue).

As the works manager of an electronics company, I had the task of firing an errant member of the shop floor staff, but made the mistake of allowing him to work out his notice. During that time he sabotaged a number of small pulse transformers, by wiring fuse wire, 5 amp rating, across the primary windings. These windings were connected into the collector circuits of low current transistors. You can imagine the results when the supply was connected. A wonderful mentality!

Brian Davies G3OUY

Continued on page 149........

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

WEST ALLIS RAC MIDWINTER SWAPFEST February 3, 1973 at Hart Park, 7300 Chestnut Street, Wauwatosa, Wisconsin (Milw. suburb). Take 70th Street exit on I-94 North 1.2 miles to Chestnut. Doors open at 8 am. Talk-in on 3985 and 14.964. Food and liquid refreshment available at reasonable prices. One dollar in advance or one dollar fifty at the door. For details write WA9KRF, 4582 South Ahmedi Avenue, Milwaukee, Wisconsin 53207.

SIGNAL ONE CX7-A w/spkr and CW filters, amazing deal at $1500. Hallicrafters FPM 300 SSB xcvr $480. Heath IB-101 frequency counter with Vanguard scaler $250. Heath SB200 linear 2 KW PEP $330. Box 230, 73 Magazine.

22nd ANNUAL DAYTON Hamvention will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt, flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. M, Box 44, Dayton, Ohio 45401.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordon Artists, Slapout AL 36092.

WANTED, OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7544 132nd Ave. N.E., Kirkland, Wash. 90833.

INCOME TAX $$$ NEEDED. Regency HR-6 $190, HR2MS 8 ch. scanner 15W $255. TME-H-LMU 16 ch. scanning rcvr 6/2/¾m $255. Digital logiclock $75. Tempo CL220 12 ch. $265. Everything brand new. Box 210, 73 Magazine.

APR-4 RECEIVER, 39-95 MHz tuner, AM-FM, excellent condition. Swap for 1920's battery radios, early ham gear, Audions, magazines. Alan Douglas, Box 225, Pocasset, Mass., 02559.

HELP SAVE 220, and me clean my apartment. 220 FM 5 watt xmtr W/AC supply xtal on 224 MHz TV-10A w/6939 final $30; 2M FM talki W/tuneable rec. 250MW on 146.34 $75; 220 superhet rec on 224 MHz $20; 500w Pwr Amp P.P. 4-125's 2 meters FM W/AC supply $85. Plus odds and ends. S.A.S.E. for list. Want URC-4&11 or other trades. G.W.B. 555 Patten Ave., Apt. 38-B, Long Branch, N.J. 07740, tel. 201-222-4508.

NEED A/C ADAPTOR for old STROBONAR V (Gold Model) Electronic Flash – Used in place of 510v battery. Please write WB6AWD/TG9 Les Anderson, ROCAP/Guatemala APO New York 09891.

TECH MANUALS – $65.0 each: R-388/URR, R-389/URR, R-390/URR, R-274/FRR, CV-591A/URR, TS-34A/AP, ALR-5, SP-600JX, R-220/URR, SP-600JX-17, RCK, TT-63A/FGC, LM-21, OS-8E/U. W3IHD, 4905 Roanne Drive, Washington, DC 20021.

FOR SALE KWM-2 with both supplies 30L-1 mint condition. 1200. shipped. First check gets them. Box 69, 73 Pine, Peterborough NH.

HITACHI DOLBY CASSETTE deck. Freq. response 20-17,000 Hz., Auto Stop, Walnut Cabinet, etc. ONLY $175. Mountain West Electronics, 23247 Military Rd., Kent, Washington 98031.

1973 HAMBURG INTERNATIONAL HAMFEST near Buffalo and Niagara Falls on September 15. Details: Valerie Orgera K2KQC, 187 Main St., Hamburg, N.Y. 14075.

73 MAG. January 1961 issue. 2 copies complete. One has loose cover. WB6LLT Jim Mills, 162 S. La Luna Ojai, CA. 93023 (805) 646-6387.

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COMPLETE SET: 73 Magazine. Volume I Number 1 to present. $100 plus postage. Roger Chaffee, 145 Bay Rd., Menlo Park CA 94025.

LETTERS continued from page 147.

As you probably already know, the ARRL has filed a petition for partial reconsideration of FCC actions in docket 19162 to amend that action to allow General and Conditional Class phone operation in the 3825–4000 kHz band as* opposed to the 3890–4000 kHz authorized by docket 19162. I feel the League makes some very sound arguments for this reform. I'm sure that many of your readers also support this reform.

I call upon all fellow amateurs to study the League's petition and give it wholehearted support. The paltry additional 10 kHz authorized by docket 19162 borders on insult in view of the fact that incentive licensing has been in effect since Nov. 22, 1968, and its effects on 75 meter phone operation are easily observable. Let's make ourselves heard! Send letters and comments to the League HQ, the ARRL Division Directors and/or direct to the FCC (don't forget the 14 copies if you write to the FCC) . . . but Speak Up Now!!!!

Let's have Seventy Five for Seventy Five!

Dave Stamps W1FUF
Groton CT

May I relate my experience in trying to purchase specific equipment.

After wasting a month, trying to get an Amperex-TAA-300-16, by writing to so-called big transistor distributors and getting, "Sorry, do not carry" and "no got's," I finally wrote the manufacturer. They sent data sheets I requested and forwarded my letter to their local distributor. He had the little gems and at a substantial reduction in price.

So if you have trouble tracking down a certain part, you might try this method.

George Brovet W9TQN
Chicago IL

I still think 73 magazine is the best of the radio publications. I would like to see more articles on RTTY and its application. Also I would like to see articles on new types of high frequency antennas. I am sure there are som e that a lot of us are not aware of and would like to know about. One I have heard of on the air is the Coaxial Dipole. I personally believe the antenna is not stressed enough in our world. The latest interest seems to be how much power a fellow can run and how much compression and processing he can get into the audio and still have it intelligible. These guys apparently have not discovered that it is the radiated power that counts. The old axiom, "If you can't hear them, you can't work them," also applies.

William A. Brink WA6COB
San Jose CA

Your editorial in the first pages of the December issue of 73 hits the nail on the head. Dannals really is a politican; hopefully he will make good on his promise. Further on you say that if each ham put up a buck, we could get a good lobby in D.C. Here's my plan:

Ham radio has often been classified with CB as a nuisance of TVI, Dick Tracy, criminal activity (see events in England and Germany during the past year where crooks used radios, called "ham" by local press), and other nefarious deeds. Perhaps the Institute of Amateur Radio barristered by some good ham attorneys could get some money by suing the TV networks for defamation of character or some such charge. Evidence: On the first episode of *Search* with Hugh O'Brian, there was a reference to crooks using two-way radios, walkie-talkies, and Burgess Meredith was directed to search the ham bands to see if he could detect the criminals in conversation. On *Ironsides*, 11/23/72, the master crook, with a touch of paranoia, communicated with the chief on 3.8 MHz. Since he was a pilot, a quick review of all people with pilot's licenses and ham tickets narrowed the hunt. Upon inspecting the criminal's apartment, wires were found and the detective asked if there had been any complaints of interference to televisions.

These are two most recent events in my mind that tend to blur the positive image of our hobby. What can we do to combine this slur with a positive action that would help us. There must be a few hams in Hollywood that can either write better scripts for the mention of ham radio, and there must be more than a few people in radio-land that would want to help our hobby to the extent of hurting the networks. We all know the ARRL wouldn't make a wave as big as this one could be.

Eric Falkof K1NUN

In the last few years a group of us here at the University of Michigan have attempted to operate a club station (W8PGW), mainly for public service activities such as phone patching. Being located in an area of high population density, we have experienced constant difficulties with TVI and RFI (hi-fi and audio interference). The hassles, legal and otherwise, are truly too numerous to mention, but the result is our belief that TVI-RFI is the most dangerous problem facing amateur radio today.

The amount of ill will generated by even a few incidents of interference is unbelievable, much more than any number of Field Day articles or county fair stations could nullify. Once a person sees interference bars on his TV or hears SSB on his stereo, he may be immune to reason for the rest of his life (we've seen too many demolished antennas and received too many threatening phone calls to expect much rationality or even courtesy from most people!). More and more of the hams we work are facing these same difficulties, and we find the residue of bad feelings among the general public to be of horrifying proportions.

The major source of the problem is the proliferation of junk audio gear on the market today. Shielding, bypassing, and even metal chassis are unheard-of luxuries. Shoddiness is the rule rather than the exception in most audio gear as well as TVs sold today. In the apartment house where I live, at least 75% of the stereo equipment, including some component amplifiers in the $300 plus bracket, were affected by my small transceiver.

All amateurs must assume responsibility for being knowledgeable about the causes and cures of TVI and RFI at the receiving end, as well as the technical standards within the shack that we have always taken for granted. Careful bibliographic research of all ham publications might be in order, as well as concerted effort to gather new ideas and approaches as they come up (could 73 help here?). I'd also like to see appropriate questions on this problem in the General Class exam — it's as relevant a topic today as any. Moreover, hams may well have to accept the cost of shielded speaker cable, high-pass filters, capacitors, and the like to relieve individual problems. Unfair? Very — but a necessary price for our survival. These problems are what give substance to the spectre of dangerous legislation and court action that haunts amateur radio.

The only lasting answer, however, is to get this flood of junk equpment improved or banned from sale. However, if we hams get feisty without national organizations and lobbies to back us up, we can expect the manufacturers and importers of this junk to work that much harder for the elimination of the amateur service. And think how much our PR troubles help their cause! Once again, Wayne, you may be our only hope.

William M. Klykylo WA8FOX
Ann Arbor MI

If you are depending on me you are rowing with a mighty weak oar . . . Wayne.

Letters cont. from page 23

Repeater was built and maintained by W2BHK, W2FLY, WB2EVU, WB2PSS, WB2PJS, W2IUI and myself.

Plans are slowly underway for solid state conversion – to run completely off of wet cells in case of emergency.

Any further information can be gotten from me if necessary.

Thank you and – Please!! – delete all those listings for Camden, Cherry Hill, etc.! People swear by your atlas and I've had people tell me that I was wrong about the location of our repeater! All because 73 said it was somewhere else!

Bruce Tiemann WB2RUH
304 Laurel Ave.
Woodlynne NJ 08107

The power supply in the September issue is terrific. Simple, inexpensive, flexible and runs like a thoroughbred.

This is the ideal bench supply for those of us who still like to tinker around and brew something up on our own.

John A. Scott W5JO
Ft. Worth TX

I read your editorial in the October issue on the never ending question, "Do amateurs build, or buy built?" Well, I thought you might be interested in what info I have on that subject. I have worked 21 States and just recently Puerto Rico and Austria. I have received 22 QSL's confirming QSO's in 10 States, and 14 out of those 22 amateurs were using kits (Heathkits or Knight) or homebrew gear. The HW-16 seems to be the favorite kit, and the HT-40 for the ready made. So, about 2/3 were made by the amateur.

I operate with the reliable HW-16 and a multi-band vertical. One piece of gear I have that I wouldn't be without is my Heath SWR/RF PWR Meter. With my sandy soil so changeable with rainfall and dry spells, a constant check on SWR is important for maximum operation.

I have been on the air since July 20, '72, and my interest has grown greater since that first day on the key when that very first CQ was answered.

Bill Armstrong WN8NKT/4
Sumter SC

Repeater circuit on P296 (Nov. 72) has no audio connection between receiver and transmitter! Goof?

Article on P37 could get some users in trouble with local board of underwriters. While it seems to be "fail-safe" most power companies would not permit such a device in a service entrance since it is not UL listed.

Gordy W1JTB

Picky, picky.

Re your editorial July 72 issue of 73 mag, re ham jamming. Good and well, but down in the sunny south (south Mississippi) where I QSO when not out on these rust pots, I note that every morn, sun or rain, some of the older citizens of "up nawth" who have moved down to south Florida, QSO with their "northern brothers" and never give up the freq. they think they own. One old S.O.B. is very nasty and wish old man Fox-Charlie-Charlie would nab this solid citizen and get him off the airways with his nasty ways.

A.K. Green "Sparks" W5GAJ
Newark NJ

. . . . Continued from page 22.

growing up to work as a lawyer, a government clerk, an accountant. No one even thinks of scientific careers. Enter amateur radio – in the high schools.

As long as the governments of smaller countries and emerging nations are not aware of the importance of amateur radio to their entry into the 20th century, they will be held back. It is difficult to approach the leaders of these countries, particularly without any prior interest on their parts. One way to overcome this would be to have a movie available which would tell the story and demonstrate it.

Dave Bell W6BVN, who made "The Ham's Wide World" and "This is Ham Radio," both shown extensively on television in the U.S., is quite interested in the project of making a film of the extraordinary school radio club program in Jordan – a film which he would distribute all over the world and which could well encourage the beginning of similar club programs in many more countries.

Such a film would not be expensive to produce and Dave is most anxious to get the project going on the basis of doing it on a cost basis as a contribution on his part toward helping the world to move ahead . . . and toward helping amateur radio grow.

Unfortunately the ARRL has shown no interest in the project so far and outside financing is needed. The whole film probably could be done for about $10,000 – about one-fifth the budget for a good one minute television commercial.

Since the school project is a personal one with King Hussein and since such a film obviously would be tremendously good publicity for Jordan, there would be complete cooperation from the government there in making the film.

Fifty amateurs with $200 each could get this started. When you remember that a small group of repeater ops recently came up with an offer of $1200 in reward money for the conviction of the chap who was jamming their repeater, perhaps $10,000 isn't all that much to hope for.

If you would like to pledge some money toward this project, please drop a line with your pledge to 73 and we will see if we are able to make the goal.

HISTORY TO BE WRITTEN?

One of the phases of amateur radio that has escaped publication in any detail has been the recent history of the hobby on an international scale. Ham radio exists as a hobby because the governments of the world agree during International Telecommunications Union (ITU) meetings that it should.

The more advanced nations of the world have a greater understanding of the importance of amateur radio and have been the ones that have done the most to keep it alive, despite pressures for taking away the amateur bands at each ITU conference.

Until the mid-60's the ITU was run by the U.S. and Europeans and, possibly as a result, these countries fared best in allocations. Then, as African nations proliferated, they joined hands with the Asian countries and swept Europe out of the control of the ITU, replacing American (and an amateur) Gerry Gross as Secretary General with an Ethiopian – then an Indian – etc.

The 1959 Geneva ITU conference had been intended as a time for updating short wave frequency allocations, but this move was stalled off until the next general meeting – which never really happened. Once the Europeans found that they had lost all control of the ITU it became almost impossible to tackle these serious problems.

The recent space conference was an exception. This was the meeting at which virtually all amateur radio satellite channels were lost. I have yet to find anyone with a background in these affairs who does not express resentment at the amateur loss and put it down to a lack of preparation, purely and simply. This is difficult to forgive when you consider that the money had been appropriated by the ARRL precisely for this purpose – but was never really spent.

These are all generalities and it is time that the record be set straight with an article or series of articles giving the inside information on what has happened – and what the future would seem to hold as a result. There are a number of our readers who are involved enough with the international situation to present such a report – how about it?

Wayne

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for radio amateurs

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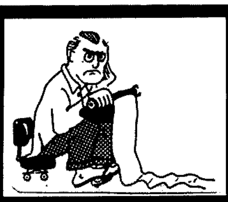

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

A NUDE COVER???

If plans go as expected, the next issue of 73 should be a landmark of sorts. You may have watched with interest (or dismay) as the lovelies on the 73 covers have gradually stripped down – wondering what was coming next.

Perhaps you knew, somewhere inside, that some day 73 would make the plunge and go all the way – not with a Playboy foldout, but with a nude right on the front cover. Well that is what is in the works.

Oh, it will be tasteful – the model's father, an old time ham, is helping with the project – and after all, it is amateur radio that is the main interest of the readers, right?

Once you get by the full nude cover of the next issue, you will find yourself immersed in FM – for this is our yearly FM issue. Non–FMers need not panic, for editor Subka has prepared a dandy bunch of other stuff too. That's one of the nice things about having so many articles in each issue. On the other hand, non-FMers would do well at this juncture to stop for a few moments and consider their attitude toward FM – about 50,000 amateurs agree wholeheartedly that FM is the biggest fun they've ever had in amateur radio – and while it is possible that they are all wrong, it is not likely.

The situation reminds me of the early days of television when many people kept telling each other that it wasn't any good – so they missed out on the fun until they finally bought a set. I was one of the early TV buyers and got to see all of the programs that are now remembered as historical landmarks – the halcyon days of television. I'm sure glad that I got into FM when I did – and I'm still enjoying. Tried it yet?

FCC CRITIZES ARRL

In the rejection of all comments filed on 19162, the phone band expansion docket, the FCC took the ARRL to task in no uncertain terms.

The FCC expresses the concept that amateurs should get more frequencies by upgrading their license and seems quite contemptuous of the ARRL's request for giving more frequencies to lower classes of licenses. Indeed, the FCC was most blunt about the fact that they intend to give more and more frequencies to the Extra Class licensees – as more amateurs get their Extra.

To quote: "Sub-band apportionments are determined by considering the number of individual licensees in each group having privileges to each sub-band, *weighted in favor of the higher classes.* (The emphasis is theirs.) Therefore, assuming the present upgrading pattern continues as we anticipate, there will be further expansion of the exclusive-frequency privileges for the Advanced and Amateur Extra Classes, and a corresponding reduction in the frequency privileges for General and Conditional Classes."

On the subject of the ARRL, the FCC has this illuminating bit to offer: "Insofar as is known, the ARRL has not initiated any recent major program to upgrade the status of the lower classes of licensees." They go on to say that, "Recent information, obtained from reexamination of certain Conditional Class licensees, indicates that probably a large percentage of that category of licensee does not meet the Commission's qualifications to occupy the high frequency bands . . . "

The Commission disposes of 18 different RM's with their blanket denial of relief in any aspect of 19162. It is difficult to accept that every single petition filed in response to 19162 was totally without merit, including the comprehensive one filed by ARRL. If, in fact, any did have merit, then the total denial of all petitions is certainly not in the amateur interest and would seem to indicate a dictatorial and arrogant attitude on the part of the Commission toward amateurs – and certainly it indicates that the Commission has no respect whatever for the opinions of amateurs – or perhaps for the amateur service.

If the Commission is to hold the respect of the amateurs it must give heed to petitions for relief, not the totally deaf ear. The recent pattern of ruthless suppression of all comments and pleas from the amateurs in the cases of dockets 18803 and 19162 is a sinister development.

FCC DOCKET 19555 STATUS

The Commission has refused to extend the deadline for comments and answers to comments on this proposed rulemaking to limit radio towers and antennas for environmental purposes.

In the many comments filed with the FCC were some good points to ponder, should this docket ever be accepted. One comment was that the FCC is not included in the official list of federal agencies involved in environmental regulation and that congress never intended the FCC to engage in any such activity. Since radio signals have no effect whatsoever on the air, water or soil, the only possible connection with the environment is esthetic – which seems totally out of field for the FCC.

If the FCC does get involved with this, the delays in construction might well run into years and millions of dollars will be spent by the government and applicants on the hearings. This has the appearance of empire building by the FCC.

The Association of Federal Communications Consulting Engineers complained that the proposal will be an unnecessary expense upon the applicants and the FCC – and that environmental impact is always a factor of concern to the local communities and is normally handled before local zoning boards. They could not see how an additional filing (and delays) with the FCC would provide any new information over the present procedure. And if these fellows don't have the background to judge the situation – who does?

One cable company mentioned that it has already had to obtain the approval of six separate agencies to build a 150 foot tower. It is difficult to see where the added expense and delays of FCC esthetic approval will add anything but more bureaucracy.

If the FCC is able to ignore all of these comments and go ahead with 19555, then not only amateur radio is in trouble – the whole country has a problem.

CROSSBAND

The recent FCC rules prohibiting crossband looked all the more foolish the other day when I sat in on a multi-hop repeater system which extends over several states and makes it possible, in emergency, to pass messages from an amateur in one state to another well over 1000 miles away.

To me, one of the reasons for the existence of our great hobby is to

promote this type of development and experimentation. Here are a number of clubs and individuals who have worked together tc set up a working system – a very intricate one – which is fun to use and could be of tremendous value shoulo the need develop. The control circuits involved challenged the ingenuity of the designers – the terrain covered is incredible, with the repeater paths jumping back and forth through mountains, sometimes on two meters, sometimes on 450.

The result was that I was able to break in with my 146 hand unit and talk over this entire network, covering over one thousand miles!

Sure, under normal circumstances the net is just used for local contacts and not hooked up for the long haul – but the control functions are there and it can be set up automatically from anywhere in the system if the need emerges. This is the type of amateur work that the FCC has recently legislated against.

And the excuse for making such a setup illegal? Frequency conservation!

When the time comes that we are really pressed for channels we will limit such systems ourselves – we don't need the Commission trying to crystal ball our remote future. And even if the time comes when the sparsely populated states have so much FM activity that 146 and 220 are both filled, the fact is that this will be for only a few hours a week and we will still have zillions of channels available for any kind of exotic long range relays or crossband setups we want during the off hours.

WHAT REALLY COUNTS WITH THE FCC?

Perhaps there is a lesson to be learned from the coming loss of the best part of the amateur 200 MHz band to the CBers.

Amateurs have been decent law abiding citizens – they have, with only a very few exceptions, observed the power restrictions – they have kept within their bands – they have used nice language – in all you probably couldn't find a more conscientious group.

The CBers, on the other hand, are the antithesis of the hams. They are illegal in just about every possible way – they use illegal power, almost without exception – they use illegal calls – a great many are not even licensed – they use illegal antennas and towers – they use illegal frequencies – they use illegal language – illegal hamming – about the only thing they have done to justify their existence is to spend money. Perhaps that is all it takes.

When you consider that there are an estimated 1.2 million CBers, and that virtually every one is operating illegally in a dozen ways – and then you compare this with the 250,000 amateurs, not one single man of which is using the CB tactics, and you realize that amateurs have committed one major sin – and it is such a sin that it is unforgivable: they haven't grown – so they don't spend as much money.

WHO NEEDS A LOBBY?

Do radio amateurs have to just sit still and get it in the neck (or lower) from the FCC? The flat rejection of every single petition for relief from the parts of the new regulations which were most objectionable appears to have sent a wave of depression through the ranks – and the resentment is growing.

Is there, in fact, any hope for relief?

We need to examine several aspects of the situation before we can come up with a good answer to the question. We must take a closer look at our complaints and see how serious they are. Are they worth a major effort to correct? Or are they just minor gripes that a few soreheads have built up into a big deal in order to attract attention? We need to see if the advantages of the new regulations are enough to trade off the disadvantages – did we win more than we lost?

If, after taking a close look at the whole situation, we decide that dammit, we are getting the dirty end of the stick – then we have to figure out what can practically be done about it. In order to work this one out, we must get some perspective on how the FCC works and what levers can be used to tilt things in the direction that we think best. This means that we have to have a rather good idea of how our government actually works – which, unfortunately, hardly anyone does.

There are two excellent recent paperback books which will give you some perspective on how our government really works. You'll find both of these books not only well worth while to read from the viewpoint of entertainment – and from the aspect of having a whole lot to talk about over the air – but you will get a good grasp on what is really happening down there in Washington and how the "system" works.

The first is the Ralph Nader Congress Project: *"Who Runs Congress?"* This is a $1.95 Bantam YZ7701. If this one doesn't bug your eyes in disbelief then you either can't read or you are a congressman.

Back up the Nader book with *The Washington Pay-off''* by Winter-Berger, an ex-lobbyist. This is $1.75, Dell 9509. Did Johnson pay Bobby Baker $1 million to keep his name out of his testimony? Etc. By the time you've read this book you'll have a good perspective on lobbying and how the EIA has been able to get so far with their proposal to take the best part of the amateur 220 band and give it to the belligerently illegal horde of CBers.

There are several other very good books on the subject, but these will give you the perspective you need for starters. Recommendations from readers along this line will be appreciated.

It appears that without a lobby in Washington amateur radio can look forward to a lingering death. The basic rules which permit amateur radio to grow or force it to wither away are determined in Washington and are determined to a large extent by politics. The recent response by the Commission to the massive protest to the new regulations certainly proves to any reasonable man that the Commission is totally deaf to input from amateurs. The question is: what can we do to be heard?

A Man in Washington could help. Someone with an understanding of the problems of both the amateurs and the FCC – a man who could talk with not only the amateur division of the Commission, but get through and talk directly with some of the Commissioners would be of inestimable help.

There has been some talk recently of the possible opening of new ham bands and of reopening most or all of the old 160 meter band. These things are possible if we have the clout to get them through. If we continue as we are now, they are so far off in the future that they will be of more interest to our children than us.

You know what is holding up the 160 band? Heel dragging by the Coast Guard. The old fashioned World War II Loran still buzz sawing great gobs of that band is as obsolete as the buggy whip. The newer navigation systems using satellites are so superior that the demise of Loran would be an international boon for it would force the few remaining users to update their equipment. A little pressure through a congressional committee and we could get the last of the Coast Guard Old Guard to give up this completely outdated service.

A lobbyist who could communicate with all of the amateurs of the country (say through 73) would have a lot of clout. He might not have as much money to hand over in an envelope for a campaign contribution,

but he would have a lot of votes he could deliver. Remember that though there are only 285,000 of us, this is not inconsiderable by the time you add up the effect that each of us can have on our family and neighbors. Sure, we represent about 0.1% of the population. But we also represent a wife – a father – a mother – father and mother in law – co-workers, etc. This can beef our influence to maybe 0.5% or even better. Show me the congressman who will not devote a whole lot of interest and time to a project that can bring about such a significant percentage of votes.

Just imagine what we could do if we ever got a burr under our blanket and set out to back up a senator or congressman! Or to sink one. There are 1600 amateurs in New Hampshire – and if we suppose that we get 500 of them to get out and work hard for a senator – extolling his virtues, talking down his opponent, getting bumper stickers all over the state – signs – organizing talks on local radio and television stations – he would be a shoo-in. And this would work the same everywhere.

We might have to prove this a couple of times– once might do the trick. Then, when the amateur radio lobbyist in Washington called a congressman and asked for help, he would get a willing ear. In case you don't know it, being a congressman is one of the very best jobs in the whole world and those that have accomplished it understand this and are willing to do just about anything to make sure that they keep that excellent job. They know that votes=money and that 1000 votes is about the same as a $5000 contribution, with no problem about reporting the money involved.

A lobbyist would know when and where it might get the most mileage for amateur radio if the national news media were used to advantage – like picketing the FCC offices – picketing the Commissioners – or something like that. Amateurs have the great advantage of being everywhere, so if it were decided that something along this line might be effective, it would not be difficult to organize a nationwide picketing of FCC offices, complete with engraved invitations to the television reporters to send cameras.

The fact is that amateurs could have substantial clout if they were organized. And the fact is that we are in no way organized, even remotely, for this sort of thing.

The ARRL does a fine job of publishing a ham magazine and inspirational booklets – it provides us with code practice through W1AW (and its paid operators) – it provides contests and awards – it occasionally files comments with the FCC. The ARRL does all of these things and amateur radio is the better for them. But the League does not get involved in national politics and with lobbying and the League has indicated that it has no intention whatever of ever getting into this.

Lobbying and Washington activity would be expensive to get started – and the League is presently operating at a net loss each year. It is perhaps interesting to note that a close examination of the ARRL operating statement for 1971 shows a net income of well over $1.5 million and expenses for membership benefits other than publishing of about $23,000. That comes to about 1.5% for the ARRL and 98.5% for QST. Obviously this doesn't leave much cash for setting up a lobbyist.

If anyone has any better figures on how much the ARRL spent on its members outside of publications and getting material for publication, they will be most welcome. There is no intention of laying out anything but the real facts. I realize that the mere mention of ARRL is enough to set some people on edge and convince them that the ARRL has been attacked. The above should not in any way be considered an attack – it is an attempt to bring things into focus so the situation can be understood. There is nothing whatever wrong with ARRL spending 98.5% of its money on publishing – this is the will of the board of directors and this supposedly represents their best evaluation of the way to get the most from the income of the League.

If there is no reasonable way to expect relief from the ARRL, is there any other possible solution? Frankly I don't know of any offhand, but if any readers have any ideas or suggestions I am sure that a lot of people will be interested. We need one good man in Washington – an experienced amateur – and we need the money to keep him in action – perhaps something on the order of $25,000 a year would do the job – and that would come to about 10¢ per amateur per year.

Now, to get back to the matter of whether there really is enough of a reason for such drastic action. After all, some argue, the armed forces need amateur radio and will never let it be killed off, so we don't have any serious worries. For that and quite a few other reasons I don't expect amateur radio to be shot down outright. But the indications are that it could easily fade away under the onslaught of discouraging rules. The recent proposal to limit ham antennas to almost unusable heights – the incredible repeater rules – the lack of more frequencies for phone ops in the lower bands – the years of delay on even the simplest of needed rule changes – the isolation of the FCC from the amateurs – the recent rejection of every single petition filed for repeater regulation changes – and so on . . . all would seem to indicate the need for some avenue of relief.

We need a system working for us that will result in needed regulations being passed in a reasonable time – we need to have some way to challenge *regulations* which are not to the benefit of amateur radio – we need to develop ways of encouraging amateur radio to grow.

Amateur radio has a great deal to give to the world – if it is permitted to do this. The hobby can help emerging countries to grow – radio amateurs in these countries can help to design, install, operate and service electronics and communications systems. Amateurs can continue and develop their ability to provide emergency communications anywhere in the world. Amateurs can develop their unique ability to permit people anywhere in the world to talk directly with other people, for not even tourists have the close fraternal ties that bind radio amateurs everywhere. Amateurs, if not prevented by bad rules, will be able to pursue their development of new systems of communications.

Imagine what would be possible in the way of worldwide amateur communications if the ARRL/IARU had managed to preserve the bands for amateur radio satellites! Imagine what might have developed in the way of multi-band repeater systems if we had had a man in Washington to help us get the regulations we really needed for repeaters! When we see what we have lost so far through not having political pressure, it is difficult to understand why anyone would be opposed to our getting such clout for the future.

The present system, which requires years and years of delay for even the simplest of changes, makes it completely impossible for the rules to be relevant. Just look at the short time it took the phenomenon of FM to spring from just a few experimenters into one of the widest spread of amateur services! Within a period of about two years we went from about 5,000 FMers to 35,000. Look at the sudden popularity of slow scan television, going from a mere handful of developers to several thousand in over 60 countries in a couple of years.

The rules should be able to keep up with these quantum jumps in interest and should be able to meet the current requirements of the

Continued on page 115. . .

SSTV SCENE

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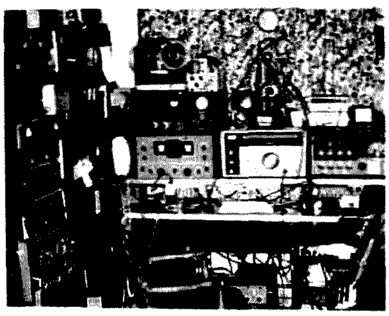
Slow Scan is one aspect of ham radio that enjoys continuous experimentation and advancement. One of these "Slow Scan specials" is stero, or 3 Dimensional SSTV. Although 3-D never really made it big at the movies, (probably because a satisfactory means of projecting 3-D was never developed) the possibilities of 3-D on television were never investigated seriously.

3-D Slow Scan may be accomplished by transmitting two pictures of a particular scene and shifting the camera (horizontally) approximately 4 inches (distance between your eyes) between the two pictures, to attain the proper difference in perspective. These two pictures are transmitted, and photographs are made of each "picture" when received on the monitor. The photographs are then viewed in a Viewmaster type 3-D viewer. Direct view, or real time pictures are also possible by using a split screen (two pictures) and prism viewing arrangement, to bring them into the proper perspective. Hmm – maybe a "snap-on 3-D viewer" for Slow Scan monitors would be the answer . . . At any rate, some interesting experimentation is possible here with your own gear.

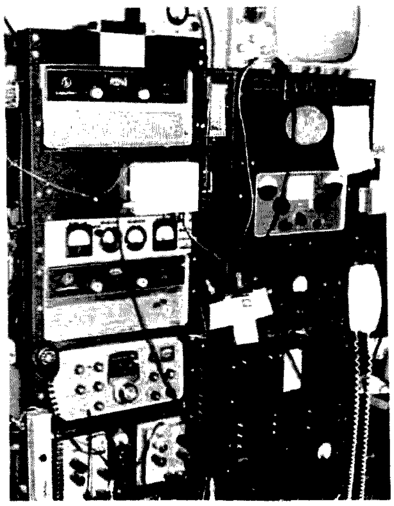
Recently, Ed K6LOM visitea King Hussein, JYL, and they shook up the Slow Scan troops on 20 meters as JY9LOM. I understand they operated from King Hussein's palace, and Ed didn't carry over his SSTV gear, so evidently King Hussein now has his gear working.

If you're building an electromagnetic monitor of F.S.S. and having trouble locating a C.R.T., yoke, or 931 phototube, contact Ben K5IRO. He has approximately 70 of each (5FP7's, 931's, 50 degree yokes, and focus yokes) available for his cost plus shipping. A limit of two per ham is desired, so all needy Slow Scanners will have a chance to acquire their necessary "goodies." Incidentally, watch for Ben's article in QST on a relatively simple magnetic F.S.S., complete with graphs for proper placement of C.R.T.'s, lens, and photo.



The W9NTP shack.

The pictures in this month's column are of the W9NTP, Don Miller's, setup. In addition to Slow Scan and satellite work, he is also active on RTTY and Fast Scan TV. I understand the flat country of the midwest is very good for Fast Scan DX. I've heard Don also has a 21 inch Slow Scan monitor so I suspect this still isn't all of his gear.



At the left is his rack of OSCAR 6 gear.

A mini Slow Scan convention is being planned for the '73 ARRL New England Convention at Dufney's Hyannis on Cape Cod, Massachusetts, durng September 29 and 30. Their past conventions have drawn a crowd second only to the Dayton blast, and their 1970 convention boasted the first Robot public unveiling. Gene W1VRK, is heading up the Slow Scan activity, so you might contact him for more info.

There are quite a few more Slow Scanners (and cameras) appearing on the air lately, which brings to mind a camera operating precaution I feel needs reemphasis. Beam current should be kept as low as possible, and target gain high enough for good quality pictures. Although good pictures are also obtained with high beam current, this will quickly "burn" into the vidicon or plumbicon target. Unfortunately, some operating manuals take this too lightly.

DX season is here again, and we're looking for pictures to run in the column. If you need them back, that can be arranged also. Any takers?

73, Dave K4TWJ

MARS

Harry Simpson A4SCF
c/o 73 Magazine
Peterborough NH 03458

A subject not previously covered in these efforts was brought to my attention by a very nice letter from a young man, Steve Antosh WB5BNM, who lives in Shawnee OK. Steve says, ". . . I am going to enlist in the near future, and I would like some advice on which service has the best all-around electronic training. I want to become a MARS member, but I feel that I should join the MARS program of the service I eventually choose!"

Young Steve is knowledgeable far beyond his sixteen years! Others would be wise to follow his example – to check into the specific training offered by each service, then make his or her choice. I feel sincerely that *all* the MARS programs are good; although administrative procedure differs, training and discipline are similar; I feel that a young Army MARS member would make a better Marine, that an Air Force MARS member would make a better sailor, and that a Navy MARS member would make a better soldier than the same individuals without such training as that offered by our MARS programs!

Several years ago I received a letter trom a young man then stationed in an Army installation in Germany. He said, in part, "I just wanted to take a moment to thank you for the Army MARS training which I received as a member of your Net. As a direct result of that training, I was able to assume operation of this elaborate Control Station with a minimum of confusion."

This young man continued the operation in Germany until his transfer to Vietnam and still another communications facility He would have had a successful career without MARS, but he feels even today that he was able to end up with the radio equipment that he loves, much more easily as a direct result of his prior MARS training – as a civilian, by the way, he is *still* an active MARS member, and a Past District Director in the Third Army program! Army MARS offers its members a Pre-Induction Certificate, to be presented to the final interviewer at the Induction Sta-

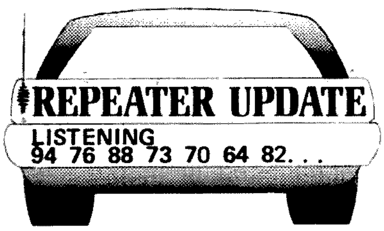
tion, as an aid to getting the proper training and assignment. The other MARS services offer a similar Certificate.

Big News! I have some volunteer assistants! For information about joining the MARS program of your choice you can now write directly to these three persons who have so graciously consented to assist me: Air Force MARS, *Mr. Andrew C. Mueller AFB9BPG, 2222 Oaklawn, Waukesha, WI 53186.* Army MARS: *Doris Dennstaedt AD3HEN, 303 N Hammonds Ferry Rd, Linthicum Hts MD 21090.* Navy-Marine Corps MARS: *Mr. Richard Crowell NØASC1, 803 Oak Plaza Rd, Kingston TN 37763.*

(Actually, Mr. Crowell didn't volunteer — I volunteered him. After I threatened to disclose his West Tennessee background he reluctantly agreed to disclose information on how to get into Navy MARS to those who are interested.)

Now that I have delegated all this authority, with the assurance that information will be forwarded to those who request it, you ask what is left for me to say — that's simple — 73.

A4SCF



CA	WA6LNU	Los Angeles (AM)	222.20–223.00
CA	WA6TDD	Los Angeles (FM)	147.435–146.40
		(AM)	147.405–
CO	WAØVTV	Colorado Springs	37–97
CT	WA1KGK	Bridgeport	147.49–146.49
GA	WB4QGF	Atlanta	444.50–449.50
IL	W9MJL	Danville	22–82
IN	K9SJI	Muncie	13–73
MD	WA3SFG	Greeobelt	28–88
MA	W1DC	Billerica	147.72–12
MA	WA1QFO	Marlboro	01–61
MA	K1UHU	Walpole	31–91
MA	WA1OXW	Fall River	146.43–147.42
TX		Mt. Franklin	28–88
VT		Mt. Snow	07–67
WI	WB9JPN	Lake Geneva	37–97
ONT	VE3GOD	Goderich	146.43–147.03
			146.46–147.06

Keep those Cards and Letters Coming!

Your new repeater, or your present machine with its new frequencies, is destined to remain practically unknown to the rest of the world unless you get the information to the Repeater Update . . . pronto!

All published updates are automatically compiled by our computer-like staff and added to the listings in the Repeater Atlas. While you can always (horrors) chop-up every issue and compile the new listings as they are published, an easier way is to send us a buck and a half for a copy of the brand-new-still-wet 1973 Repeater Atlas. It contains a listing for every repeater known, including maps, open or closed status and tone frequencies. Update!

ARRL RESOLUTION

One of the more important developments in the FCC vs amateur radio battles was the following resolution by the ARRL Board of Directors in January. This is a strong statement and it puts a heavy load on the shoulders of the president and general manager of the League for it says that in effect the Board is holding them responsible for results.

WHEREAS, the highly developed radio communications technology existing in the world today is the direct outgrowth of contributions made by radio amateur enthusiasts over a period of more than 70 years; and

WHEREAS, the government of the United States including various administrative agencies, has traditionally followed the policy of permitting and encouraging the development and growth of the amateur radio service by adoption of only minimal regulations and broad general policies; and

WHEREAS, under the policy of minimal regulation the amateur radio service has developed to an extremely high level of proficiency and service to the nation in times of disaster and national emergency as well as in normal periods; and

WHEREAS, the Federal Communications Commission in recent months has adopted a number of amendments to its regulations and issued a number of interpretations of these and other regulations which evidence an abandonment of the policy of minimal and self- regulation followed so successfully over the years, and has other proposed restrictive amendments under consideration which, if adopted, will further increase the level of governmental regulations; and

WHEREAS, these developments and trends are a matter of the greatest concern to amateurs throughout the nation and to the American Radio Relay League, the only nationwide membership organization representing active amateur radio licensees of all ages and interests; and

WHEREAS, a great number of amateurs, individually as well as through their local clubs affiliated with the League, have expressed deep concern over the apparent trend toward progressively restrictive and unilaterally-imposed regulations governing the Amateur Radio Service, and the potential inhibiting effect of this upon the orderly development of the Service as a public resource, as well as in carrying out the charter in Section 97.1 of the rules,

Now, therefore, BE IT RESOLVED, that the President and the General Manager are directed to undertake a vigorous program to seek reasonable and technically viable philosophies of regulation and interpretation, conferring at all necessary levels with appropriate Government departments and officials, and recommending to the Board of Directors courses of action which may be required to assure the continued availability of traditional latitudes and freedoms, and the full public service capabilities essential to the growth, improvement and usefulness of the

Adopted Unanimously
January 18, 1973,
by the Board of Directors of the American Radio Relay League.

APRIL CRUISE

Are you really going to pass up the 73 Caribbean Cruise which runs from April 3rd until the 13th? Come on — join us all for a lot of fun — for ham talk — visiting very rare islands you otherwise would never see — for some DXing — for plenty of sun — swimming — skin diving, if that turns you on — and sailing.

The price runs about $290 per person for the ten day trip — which is a darned good bargain these days. If you think you're interested get in touch with Captain Mike, Windjammer Cruises, Box 120, Miami Beach FL 33139 — telephone: 305-672-2213.

As of the first of the year there were about a dozen signed up for the trip — including some of the better known amateurs. It'll be fun. It starts from Antigua and ends up there again after ten glorious days.

DX FOOTNOTES

Those of you who have not sent in your score for our 73 - 73 - 73 Award (73 countries, first 73 days of 1973). Had better check over your log and get your list (verified by some club official or 2 hams) so that we can send you your certificate.

We still need quite a few more DX Clubs to act as WTW verification points. This is a good way for your club to get a little publicity because we will be mentioning their name and address a few times each year. The work load will not be too much, just the checking of the WTW applicants in your district. Discuss this at the next club meeting.

I hope by now all those planned winter DXpeditions have come to pass as they were planned. Many things can and does happen to make things not ever turn out as you would like for them to and this seems to happen more to DXpedition plans than anything else, all which goes to show that "something" happened that you didn't think of and I bet "money" is one of those "stoppers" ! In my case it has usually been Nr. 1. So fellows if you are thinking of a DXpedition, get your money problems attended to first. Of course there are "other things" to remember. Get used to eating odd food, not the best of accomodations, maybe no running hot water (not unless you call a native running with hot water to your room, "running". Get used to having to defend the U.S.A. (especially true I guess now). I would also guess the U.S. Dollar is not as "shiney" as it used to be either. Get ready to do battle with Customs in some countries (some will be easy if you "hold your mouth right"). Get used to having to do a lot of "talking" to taxi drivers, many of them will "drain you dry" ! The same usually goes with anyone giving you any kind of service (maids, doormen, butlers etc.) You will not have air conditioning, good heat etc. You will have to do as the old saying, when in Rome, do as the Romans do, something you may not like to do. Then when you get on the air to work the fellows, there will be a lot of deliberate QRM on your (and the other fellows) frequency, some will call you every day just to say hello, call letter districts will most definitely call out of order, you will be accused of working too much CW or SSB, favoring certain districts or calls. Then when its all over you will get cards from fellows who will swear with witnesses that they have worked you at such and such a time, band, etc. And they will not be in your log ! NOW, DO YOU STILL WANT TO GO ON THAT DXPEDITION ? Well I DO ! And I bet you will still GO ! I want to warn you, be careful, it will get in your blood and you will not ever want to quit, it got in mine ! Now don't say I didn't warn you of just a few of the "hazards" of being on the other end in a big DXpedition pile-up. It's great and sometimes its rough going.

I wonder when someone will again be on from such rare ones as Iraq, South Sandwich, Clipperton Island, Bouvet Island, Spratley Island again, the many different reefs (some they say are under water), AND ROCKALL ? All I can say is WORK THEM WHEN YOU GET A CHANCE because it may be a long time before you get another chance. Most of them are difficult if not down-right almost impossible to put on the air.

I hope by now that most of you have worked the countries you need on ten meters (unless you still need such places like Brazil, Argentina, Canal Zone, and other countries south of your location, because when ten is closed by those thinned out sun spots thats all you are going to hear or work. The ten meter band this winter had all the "ear-marks" of being on its last leg, and in a few more winters you will still have fifteen to work, and then it will be the next one to "go" ! Better make hay while the sun shines on the fifteen meter band.

Any of you who have future DX-pedition info (at least three months advance notice) please send me the info for publication if you want the fellows to be waiting for you and when its all over send me the story and a few good pictures, we will do the rest and hope it will give you a little more "glory" ! We can always use little DX stories, info, pictures etc. Keep us in mind please.

A group of fellow DXers headed by VE6BAA and VE6TP have announced some "big" DXpedition plans (in late November) and we all hope by now that they are well on the road. They have announced plans to put on the air the first ten or so most needed countries. I can see a lot of money being spent on this trip or trips when you consider they plan to make a series of movies (they will have a movie making crew along with them in addition to the ham crew (I guess some 3 to 5 hams). Someone must certainly have a "bank-roll" to see all their announced plans materialize. Of course they will accept any donations sent them (and they will need PLENTY) not unless there is a very rich "sugar-daddy" in their crowd. The frequencies for working them is as follows:

SSB-3770 - 7080 - 14190 - 21245 -and 28550 kHz.
CW-3505 - 7004 - 14025 - 21025 -and 28025 kHz.

All QSL cards to them should go to:
VE6BAA, R. "Bob" Sutherland
c/o Canadian World DX-pedition
Edmonton, Alberta - Canada

Donations with your cards will be FB. Their first stop that was planned for late December was put off until Jan. 1973 and we hope it is "past-history" by now and that they are at some of those other "goodies" announced by now.

As I predicted a long time ago VS9 (Aden) is a rare spot since the "G" fellows pulled out and by now EA9 (Spanish Sahara) has probably joined the rare country list because EA9EJ Justo was to have left there for EA8 (Canary Islands) in late December and DXpedition planners will find it very difficult to get a license and permit to operate from that spot. I spent 2 fruitless weeks in Madrid trying and I never even found the "right man" to talk to ! Oh, I was sent all over the place (the usual "run around"), and I went everywhere they sent me, none of which did any good what so ever.

Fellows, remember when you are chasing some of that DX and the other fellow on the other end is not an Eager Beaver DXer, and that working one more "W/K" is Duck Soup tc him that he is the one thats doing you a favor by working you. So I very strongly suggest you play the game by His Rules (by districts, lists etc.) You may not like his rules, but he is his own referee and he does things like he wants to. He is the fox and you are the hunter.

Tim Fitzpatrick ET3USB and WB8BOI. Tnx to WB8BOI for photo.

To be a GOOD DX'ER takes work, planning, a good rig and antenna, and of course a certain amount of time. But, you will never enjoy it all more than when you are "in there" working them in the pile-ups !
Each night just before you doze off to dreamland be sure to REMEMBER:
1973 is 73's year, repeat that each night - Lets keep Wayne Happy !

73 etc. de, Gus B P D

AMSAT NEWS

Mike Frye WB8LBP
640 Dauville Dr.
Dayton OH 45429

Now that OSCAR 6 is a success, AMSAT is busily involved in the construction of AMSAT-OSCAR-B. AMSAT hopes to launch the satellite soon after OSCAR 6 ceases to operate. AMSAT needs volunteers to assist in the development of satellite hardware. Administrative and financial help is also needed for this project to be successful.

I am really sorry to learn that some stations are using excessive power in transmitting to the OSCAR 6 satellite. This of course is clearly a violation of Section 97.67(b) which limits amateur radio stations to "... the minimum amount of power necessary to carry out the desired communications." It also violates the rights of fellow amateurs. I have talked with quite a few friends who have tried to make a contact only to have interference from a high powered station blot them out.

I am happy to announce that many amateurs sent comments to AMSAT with suggestions for future projects. One proposal that has been considered came from Joe Kasser G3ZCZ/W3 – he has suggested the idea of having a repeater attached to an atmospheric balloon. The program would investigate the use of non-space qualified hardware to enable tests to be made on hardware that will be utilized in future space flights. If you have any ideas on this subject, please send them in. Also, if you have any experience in balloon work and would like to help, write to Joe Kasser at the address listed in his "Travelling Ham" column.

Other ideas involve a synchronous orbit for OSCAR 7 – this would allow the satellite to be at optimum position most of the day. It would also allow for the numerous contests and DX possibilities that would be welcomed by all. Many other atmospheric and propagation tests were suggested for OSCAR 6, and I have heard that a group of amateurs are already getting fair returns on their experiments.

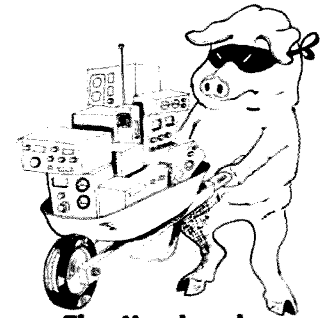
Please continue to send in your suggestions to AMSAT, as we are still looking for new ideas.

The next column will include – hopefully – some of the data observed from the tests with the satellite. Be sure to monitor the three AMSAT nets to learn how to listen for OSCAR if you are still having trouble.

AMSAT NETS

3855 kHz every Monday at 2400Z (7:00 p.m. EST)
14,280 kHz every Sunday at 1800Z
21.280 kHz every Sunday at 1900Z

WB8LBP



The Hamburglar
STRIKES AGAIN!

Roy Barker WA8PCG had a Standard 826M 2m FM rig, serial no. 112007, stolen from his automobile recently. If anyone has information of the whereabouts of the rig or of the theft itself, please contact Roy at 23185 Maybelle Dr., Westlake OH 44145 or the Cleveland Police Department.

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
Yaesu FT-101 No. 107036	WA2YSW	4/72
Standard 2m FM No. 102703	W6NPV	4/72
Drake ML2 No. 20189	WB2LLR	4/72
Standard SRC-806M No. 009210	K1TLP	5/72
Aerotone 6M 355LT, No. 685064	RR Police Grd.Ctrl.Trml. NYC	5/72
Standard SRC-806M, No. 102703	C. Mathias 3234 Coronado Ave Imperial Beach CA	5/72
Lafayette HA-410 No. 009210	WA2KDG	5/72
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Swan Cygnet 270,No. 313022	K4ACJ	9/72
Collins Mic, Mod. MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No M-395430	W8HST	11/72
AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73

WHOOOPS

The notice making kits available for the Handy-Talkie Touch Tone article on page 32 of the January 73 issue was worded incorrectly. W1WJR is NOT offering complete kits... he is offering just the pad and switch for the listed price. The mistake was *our* fault... we simply misunderstood Tom during a telephone conversation.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

KØTVD reports the band open from Nebraska nearly every day during December, with the 9th and 17th being exceptionally good to the east coast. Santa brought Chuck a new 11 element Telrex. He hopes to have its 36 foot boom at the 70 foot level by early spring.

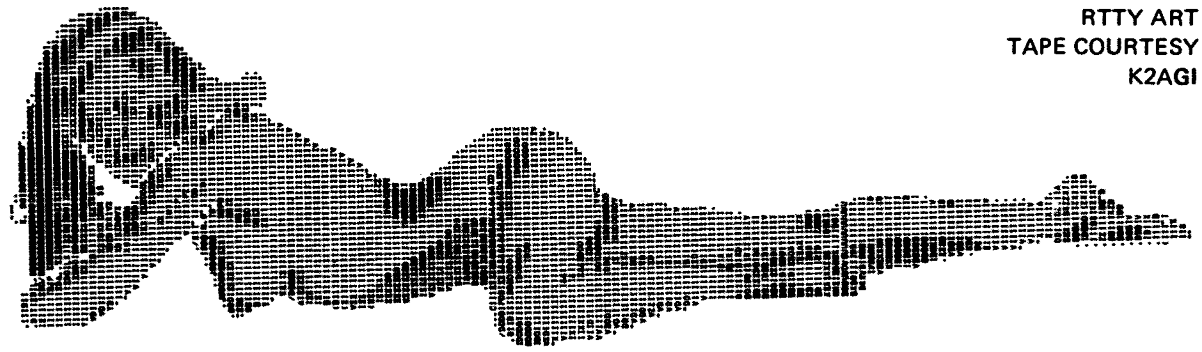
WA1EXN, Maine, reports E and/or scatter contacts during 13 of the last 22 days of December.Among those heard and/or worked were WB4LHD, WA5YJR, WA5MZW, K9HMB, WA4MHS and WA5SJM. Art is toying with a 25 mW CW rig on 50.178. "So far have made only local contacts but will be looking for DX next summer. (I think I must have been dropped on my head when I was small.)"

The local area shared the fine December openings mentioned by Chuck and Art. Among those heard here were VE1PL, W2EIF, K3CFY, WB4BND, WA1JEX, WA1NNW, WB9ETQ and KØMST. The first few days of January were not bad, either – WA7FPO and WA7BXK were heard around 0100Z on the 2nd. Charlie, WA1PFA, was worked at 0330 on the 6th after he finished chewing the rag with K8LEE. Wayne could be heard but not copied off the back of his beam.

The January ARRL contest was a complete and absolute bust in this area. Few stations attempted to participate – even the normally good groundwave to 300 or so miles was poor.

While on the subject of contests, don't forget the "Worldwide VHF Activity" sponsored by the Itchycoo Park VHF Amateur Radio Society. It runs from 3:00 pm local March 10th through 10:00 pm local March 11th. Full details are to be found in "Social Events and Contests" in the January issue.

Several weeks ago I noticed an ad for a new 6 meter transceiver and wrote the manufacturer for further data. This information has not been received as yet, so I will pass along what I know about it. The manufacturer is SBE, the rig is solid state, 20 watts PEP SSB and 10 watts AM. Frequency selection is by 23 synthe-



RTTY ART
TAPE COURTESY
K2AGI

sized 10 kHz channels (incremental tuning?) which makes it sound much like a conversion of a CB rig. The coverage is from 50.050 to 50.280 which would seem to be reasonable. Hopefully the PR department at SBE will be able to fill in a few of the voids before the next column deadline. How about a new rig before the next E season?

A little more information on the Tempo 6N2 linear I mentioned last month. This is a table top unit with self-contained power supply using a pair of Eimac 8875's. The input is 2 KW on SSB and 1 KW on CW and FM, 50 to 75 watts of drive are required. Deliveries were scheduled to begin in January at $545.

You might want to look for the "Ohio Valley Coffee Club" at 8:00 a.m. EST Sunday on 50.150. Another net to look for is the "East Coast SSB Net" at 11:00 a.m. EST on 50.175. W3MFY passed the word on this one from the Philadelphia area.

I have an inquiry about the solid state 6 meter transverter kit available through the English language version of UKW-BERICHTE. I have not personally seen or heard one. Can anyone supply a first hand opinion?

WAØABI

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

It was in 1962 that I last tried my hand at writing. I must admit that I am more than a slight bit rusty at it. Why then am I crazy enough to undertake what I hope will become a monthly column about FM activity in the Southland? Perhaps the answer would be simpler to explain if you permit me to digress for a moment.

I believe it was in April of 1970 that the incident took place. I was here in Los Angeles on business and had a borrowed P33 with me. The only rocks in the thing were for 94 simplex. I had been quite busy that day trying to peddle light shows, and to relax I decided to see what I could work from my hotel room. I gave a short call, figuring that my WA2 call might attract some attention and lead to an interesting QSO. It attracted attention all right, but hardly the kind I was expecting. As soon as I let go of the PTT button, I was greeted by a fellow amateur (I use that term quite loosely) who never bothered to identify himself. Instead he spent the next three or four minutes explaining to me that I was not welcome on 94 and that I had better get off the air or else. Needless to say I was startled by this. When I asked why, I was answered with a tirade of four letter words that would make a sailor blush. Since I was leaving for Albuquerque the next morning, I turned off the P33, packed it away, and went to visit some friends instead. (They are of the non-ham type, so the evening was spent talking of film making rather than ham radio.)

It was not until I returned to New York that I learned this was not an isolated incident. Others, I was told, had been greeted with the same "warm welcome" of true amateur friendship. Though I wondered why, with time the incident was forgotten. It was six months later, when I again came to L.A., that I learned the answer. This time I carried with me a Knight TR-108 two meter AM rig. It was during one of the many fine AM QSO's I had during that stay that I learned about FM in Southern California and about Remote Base operation in particular. It seems that I had been on someone's remote base frequency and apparently he didn't appreciate my intrusion. What bugged me then, and still does now, is why this guy didn't take the time he spent threatening me to explain about his operation. I would have been happy to comply with his request not to use the channel. No, instead he made himself look quite small in my eyes and helped to give this area some undeserved bad publicity about two meter FM and the people on it.

Back East, most of the people I have encountered believed as I did that FM in Southern California is very unfriendly, and the people involved in it are of the very up-tight variety. This, as I have come to find out, is far from the truth. It was Fred Deeg K6AEH of Standard who opened my eyes to the true facts of FM life here in L.A. I first encountered Fred on WA2SUR when he was in New York last spring. We had quite a QSO that evening and Fred invited me to visit him if I ever got to L.A. again. Eight weeks later, I called Fred to tell him that I was here hunting employment and would like to take him up on his invitation. I visited Standard the following afternoon and after a tour of their facility, learned about repeater operation in this area. Fred is probably the best public relations man for FM in Southern California today. Why not – after all, he works for a company that is in good part responsible for the rapid growth of amateur AM all over the nation. He is also one of the founders of WB6ZDI, the Pallisades A.R.C. repeater, which is fast becoming to Los Angeles what WA2SUR is to New York. It was because of Fred and others I met, like Bob Greenberg WB6INR, that I totally changed my mind about two meter FM in Los Angeles. It was Bob who was the inspiration for this column, but more about that later.

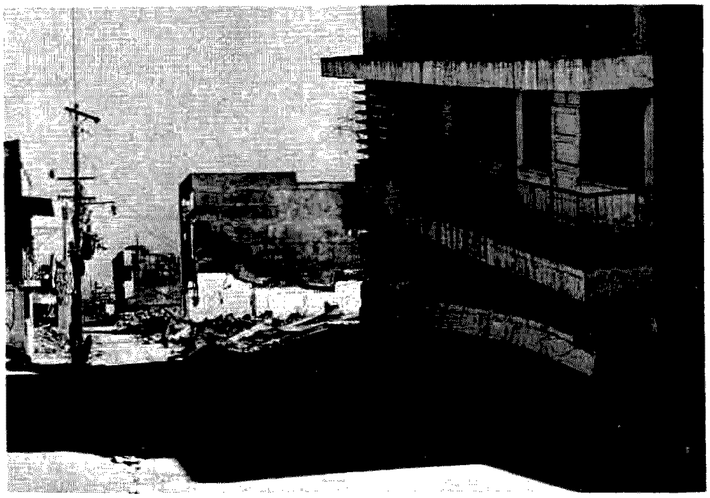
I next spoke to Fred in mid-October, when we arrived. By that time, the Southern California Repeater Council had held its coordination meetings and the changes were going into effect that week end. Fred supplied me with a list of the new allocations, and a call to International brought the necessary crystal combinations. This got me on the air, and

Cont. on page 18...

report from MANAGUA

A destroyed city is not the greatest place to spend Christmas, but Managua has brought to us a holiday we will never forget. When planning our one-year journey through Central and South America, we had no idea it would prove to be filled with such adventure.

We first heard news of the earthquake Saturday evening, December 23, while camping at Lake Ilopango in El Salvador. Information was difficult to obtain; communication was obviously a problem. Nine months of effort gathering amateur radio licenses from all nations of Central and South America culminated into one moment of great opportunity. We had something to offer the people of Managua – a fully mobile amateur radio station capable of sending messages throughout the world. Words were not necessary; the decision to go had been made. It took a night and a day to gather extra food and water and to drive to the disaster area.

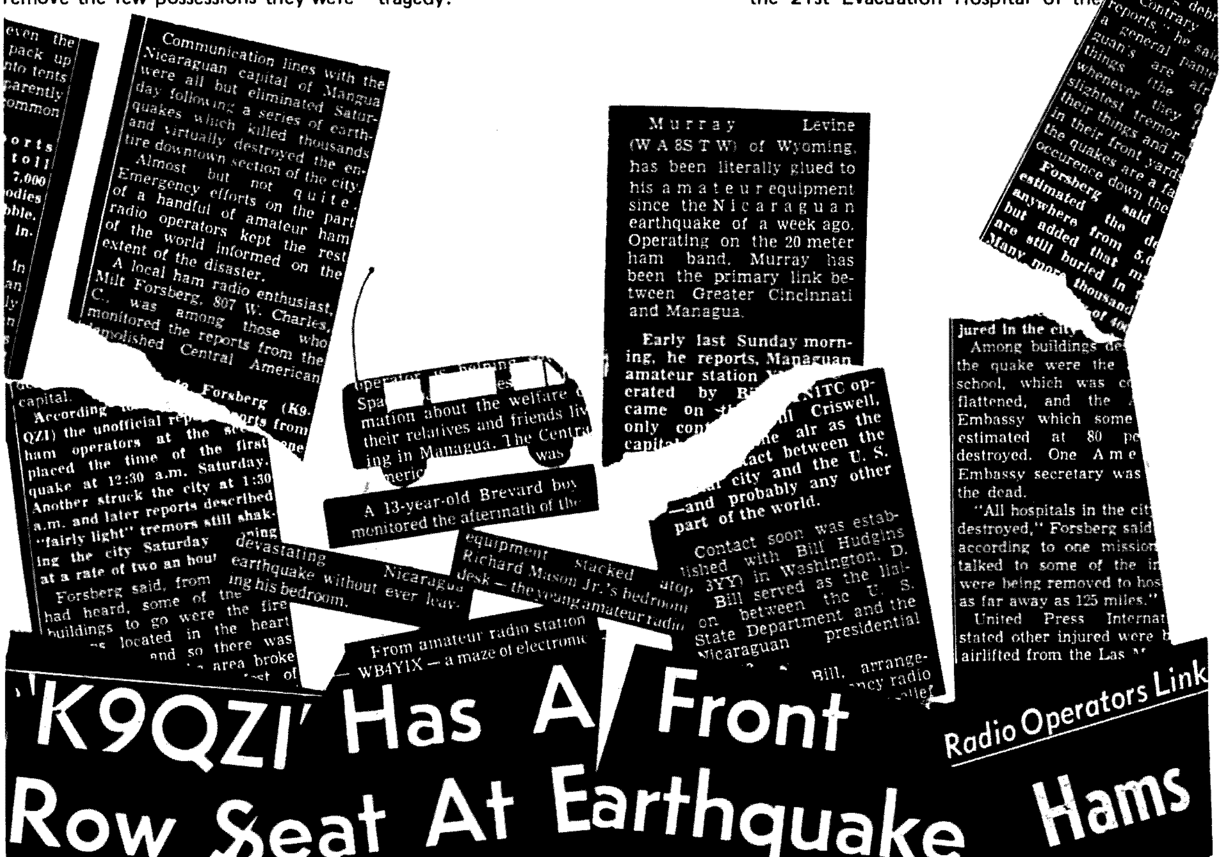


Those missing buildings tell the real story of the extent of the disaster. Photograph by Don Goode.

On Christmas morning we entered the city. The scene was not a pretty one. Families sat on couches or chairs in front of their crumbled homes waiting for cars or trucks to help them remove the few possessions they were able to salvage. To prevent disease spreading throughout the city, bodies were burned in the streets as rescue operations continued to uncover the victims trapped in the debris. The people of Managua maintained a surprising calm in the midst of all this tragedy.

For five days, our white Volkswagon bus with the mobile radio unit was used throughout the city to send and receive messages. "The family is alive and well" were the happiest and most familiar words transmitted.

Hurriedly dispatched to Managua, the 21st Evacuation Hospital of the



Communication lines with the Nicaraguan capital of Managua were all but eliminated Saturday following a series of earthquakes which killed thousands and virtually destroyed the entire downtown section of the city.

Almost but not quite. Emergency efforts on the part of a handful of amateur radio operators kept the rest of the world informed on the extent of the disaster.

A local ham radio enthusiast, Milt Forsberg, 807 W. Charles, C., was among those who monitored the reports from the demolished Central American capital.

Murray Levine (WA8STW) of Wyoming, has been literally glued to his amateur equipment since the Nicaraguan earthquake of a week ago. Operating on the 20 meter ham band, Murray has been the primary link between Greater Cincinnati and Managua.

A 13-year-old Brevard boy monitored the aftermath of the devastating Nicaraguan earthquake without ever leaving his bedroom.

From amateur radio station WB4YIX – a maze of electronic equipment stacked atop Richard Mason Jr.'s bedroom desk – the young amateur radio

Contact soon was established with Bill Hudgins, 3YY, in Washington, D. C. Bill served as the liaison between the U. S. State Department and the presidential Nicaraguan

Among buildings destroyed in the quake were the school, which was flattened, and the Embassy which some estimated at 80 per cent destroyed. One American Embassy secretary was among the dead.

"All hospitals in the city destroyed," Forsberg said according to one missionary talked to some of the injured were being removed to hospitals as far away as 125 miles."

'K9QZI' Has A Front Row Seat At Earthquake

Radio Operators Link Hams

United States Army from Fort Hood, Texas, arrived *without communications equipment*. The YN1LEY mobile unit quickly established contact with Fort Hood and extra doctors, nurses, and medication were dispatched immediately.

Telephone lines were down, electricity was off, and gasoline was difficult to find. United States newsmen covering the disaster had great difficulty getting reports back to the home offices. Our Swan 500C worked day and night getting the news to the American people. Great band conditions and cooperation from ham operators in keeping the frequency clear, enabled us to file broadcast quality news reports to WBT in Charlotte, North Carolina, Voice of America in Washington, D.C., and the Texas State Network in Dallas.

Bill was a valuable communications link to the outside world immediately after the earthquake. Lucky for the U.S. Army, he was on hand to contact Fort Hood and remind them they forgot to send radio equipment along with their personnel. Photograph by Don Goode.

Transportation was a critical problem in the city. Vehicles not crushed by falling debris were used exclusively to move people from the city. Our bus moved through the streets of Managua carrying photographers, newsmen, doctors, and embassy officials.

Shooting was prevalent during the nights as the Nicaraguan LaGuardia attempted to stop the looting. We suffered some tense moments one evening as bullets ricocheted overhead.

Incoming messages requesting information on the welfare of particular families were difficult, if not impossible, to handle. Most homes had been destroyed and people evacuated. However, some messages did get delivered.

One message in particular from the Vatican to the Archbishops in Nicaragua held an unusual experience for us. General Somosa, military leader of Nicaragua, accepted the message personally and assured us it would be delivered. It was quite an honor to shake his band.

One our fifth day in Managua, a badly overworked relay in the Swan 500C died. One last transmission was attempted and a replacement unit was ordered from Swan Electronics in Oceanside, California. The part was expedited immediately from the factory and, much to our delight, the radio is back in operation.

The tremendous assistance and cooperation of amateur radio operators throughout the Western Hemisphere made our efforts in Managua truly successful. We are proud to be a part of the amateur radio brotherhood.

Bill and Mareta Pomeroy
YN1LEY / WA2LEY

I've come to make many new friends.

This, though, set me to wondering why no one had taken the time to write on an on-going basis about FM out here, considering the fact that Southern California is the place that gave amateur FM its start. No, I'm not the first. The credit for the pioneering effort must go to Bob Greenberg. It was Bob's excellent letters that were printed in the Repeater Bulletin that first made those living elsewhere aware of current trends in and around this area. Perhaps it was the national publicity garnered from Bob's journalistic effort that was at least in part responsible for the quick action in standardizing the repeater channels. It was directly from Bob's effort that Looking West has been born.

Here, then, is the reason for Looking West. Though FM is big all over the country, most of what we read or hear is about the Northeast and New York. Little information is available on what's going on elsewhere. If I had known in 1970 what I know now, the incident I described at the beginning of this column would probably never have happened. How is someone from one coast supposed to know what's happening three thousand miles away. The purpose then of Looking West is to bridge those miles. I hope that it becomes a place for amateurs who are devoted to FM on both coasts – and in between as well – to exchange ideas that will benefit all. To this end I will need your help. Let me know what interests you, and we will do our best to provide information. This goes for all facets of FM, be it technical, philosophical or what have you. However, this won't be a place to air anyone's dirty linen. If you have a personal gripe about someone you might just as well save yourself the trouble of contacting me. I can assure you it will never get into print. On the positive side, if there is a matter affecting you that might affect us all, then that's news. When I say "you," I am talking to clubs and repeater organizations as well as the individual FMer.

Do we need a national repeater organization? Most repeater owners already belong to one or another regional repeater council. Some of them are excellent, but they all have one drawback. They represent only a small number of people each, in relation to our total FM population.

Many of us feel that we have been treated unfairly by the new FCC regulations governing repeater operation. Though many petitions have already been filed to stay or alter the new rules, it is yet for a concerted effort on a nationwide scale to develop. If the FCC received 10,000 petitions, all properly filed, they would be forced to at least re-think their decisions. A national repeater organization of owners and users could organize an effort such as this. Just a thought. What is your opinion?

The future of 220 MHz. As we all know, the motto around 73 has been "220 – Use it or Lose it!" Well, the fact still stands that if we amateurs don't start using 220, we *will* lose it – and to the same crowd that took eleven meters from us. The best reason to fight to keep 220 can be found by SWLing the 27 MHz Citizens Band some evening. No, I am not against CB, only the way that it has come to be used. If the FCC had been strict in enforcing its own rules governing CB, we wouldn't have the fiasco we have today. Why complicate the mess even further by adding 220 MHz to it?

A number of years ago the Gonset Corporation made a pioneering effort to populate 220 with their Communicator IV-220. (See November 1962 73 magazine for an excellent review of this rig, if you can locate a copy. Mine is not for sale.) Though their radio was state of the art for its day, very few of us were willing to shell out almost $400 to try a band that held little in activity. Between now and then there has been little or no equipment manufactured for the 220 MHz amateur band. Now, however, that is all changing.

Henry Radio beat everyone by announcing their compatible FM-AM 220TR, and followed that with their twelve channel ten watt Tempo 220. Already, most of the other major manufacturers have announced 220 MHz radios to become available later this year. There are rumors around here that Henry will soon have a 220 MHz repeater on the air. Nice work, Ted.

One thing that has been puzzling me for some time is why a progressive kit supplier like the Heathkit company has not joined the amateur FM trend. There are still some of us who prefer to "roll our own," at least partially, and I for one can see a good market for 144 MHz, 220 MHz and 450 MHz FM transceiver kits and monitor receiver kits. After all, wasn't it the venerable Sixer and Twoer that opened VHF to the average ham at a price he could afford? How many of you started your VHF career with one of those Benton Harbor Lunchboxes? It was an old Heath CB-1 converted to six meters that was my first mobile rig, and it's still in use as a base for local ragchews. Come on, Heath – how about an FM 1¼'er?

While on the sobering subject of 220, I am happy to report there is now a 220 MHz repeater operational in greater Los Angeles. It is the work of Lynn WA6LNU, and the machine bears his call. At the moment the machine is AM, but word has it that Lynn plans to convert to FM sometime in the future. AM or FM – at least it's a step in the right direction. I'm still in the process of brewing up a 220 transceiver (see, Heath, I told you so) and as of now I have not heard the machine myself. From what I have been told, though, it already has a bunch of active users.

A number of other machines are already in the works, and all signs point to a concerted effort to save 220 out here. History at times has a nasty way of repeating itself, so let's not help it do so this time. USE 220 AND KEEP THE CALL SIGNS HEARD THERE AMATEUR CALLS!

Christmas on WA6TDD. As a small child, one of the greatest joys of the holiday season was to visit one of the local department stores to see Santa Claus. Wasn't it thrilling to sit on his knee and tell him that you had been a good boy all year and were worthy of his good graces come Christmas Eve? Again this year thousands of kids all over the country had their chance to tell the kindly, bearded man in the bright red suit what they wanted to find under the tree.

But some children were not quite that lucky. I'm talking of those who were confined to hospital beds. How could they tell Santa what to bring? Thanks to the people who operate WA6TDD (147.435–146.40) and members of the Alhambra Radio Club, many of these kids were able to talk directly to Santa via the "Annual WA6TDD Phone Patch to Santa."

With members of the aforementioned Alhambra Radio Club (K6AC) handling Santa's end, it was up to Orlo K6SUJ and Eric WB6EST to do the leg work at the hospitals. This they handled with great talent. Because of their efforts there were quite a few happier hospitalized kids in the Los Angeles area. When we speak of amateur radio as a public service, we usually think in terms of emergency communication in time of disaster. I ask you, though, what greater public service can we hams give than to make a child smile?

Traveler's Note. To those amateurs who plan to use two meter FM while in the Los Angeles area, I personally recommend WB6ZDI (146.01–146.61) and WA6TDD (147.435–146.40). The people on these machines are very friendly and have gone out of their way to make your reporter welcome. ZDI has one

Continued on page 107....

*Lindsay Winkler W6WMI**
81-452 Francis Avenue
Indio CA 92201

A FAST SCAN FACSIMILE SYSTEM WITH SSTV COMPATABILITY

Mechanical systems of picture presentation popularly referred to as facsimile are not new to amateur radio. Such systems were used extensively back in the 1920's when scanning discs produced the pioneer equivalent of SSTV on the 150–200 meter band, where it was then legal. The relegation of all facsimile to the VHF placed most interested experimenters in a communications vacuum and has probably been the major factor in discouraging amateur facsimile.

The presently legal system known as SSTV, though facsimile, seems limited to TV methods; however, the perimeters of the system are readily adapted to other systems of facsimile transmission and reception which are not limited by the 8-second useful persistence of the P-7 phosphor.

When so adapted, these other systems immediately become as legal on the DX bands as SSTV, thus broadening the potential horizons of those experimenting with these facsimile systems. The development of the perimeters of slow scan and their eventual legalization represent the great contribution of Copthorne McDonald[1] to the amateur art.

Typical fax pictures from the author's fast scan unit.

Most any system of mechanical readout may be adapted to the 15 line per second requirement of current SSTV. The drum system will produce beautiful pictures when carefully built, even when the drum is a rolling pin borrowed from the kitchen, as witness the systems described by Anderson[2] and McKnight[3] for use in the reception of weather satellite pictures.

Little besides the drum and lead screw speeds and the video diode polarity need be changed to produce excellent slow scan pictures. However, such systems might not prove too attractive because of the necessity to retool between each picture, and the expense of the paper. Electrostatic paper under the same conditions is less expensive, but has the same "retooling" disadvantage.

After several years experience with amateur APT weather satellite readout using several different systems, the writer adapted the continuous readout helix blade principle used in many commercial facsimile systems to home fabrication from readily available materials. The adaptation worked beautifully, using the inexpensive electrostatic papers available to experimenters in small lots.

When a lull in APT interest was brought on by the premature demise of the excellent weather satellites ITOS-1 and NOAA-1 and the launch failure of ITOS-B, I became interested in adapting the latter system to compatability with current SSTV perimeters as developed by McDonald and now used universally.

The big advantage of such a system is to provide legal worldwide facsimile capability to those wishing to build their own facsimile equipment. As long as the transmitted signals follow the format of SSTV, these activities are obviously perfectly legal despite the equipment used for generating and receiving the signal. Furthermore, by the simple expedience of slowing the "vertical" scanning rate to send and receive the pictures in double or quadruple the present 8-second limit of the useful brilliance of a P-7 phosphor, the number of lines per picture and thus the resolution can be doubled or quadrupled. (It is recognized that other perimeters such as spot size must also

be optimized in order to get the full improvement in resolution.) With the present wording of FCC regulations, such experimentation must await the development of amateur interest in such increased picture resolution.

The continuous readout helix blade principle allows the paper to roll continuously off the roll. This is scanned horizontally and then flows continuously out of the machine. Using electrolytic paper, the scan can be viewed immediately on completion of the individual line.

The basic principle of the system is at first more obscure than that of drum or scope readouts. It becomes readily comprehensible if one will get a cardboard tube, such as the core of a paper towel roll or a rolling pin from the kitchen, and wrap a single spiral turn of string or wire from end to end on it. Holding this tube parallel to the edge of a ruler, the tube is then rotated and the movement of the point of contact watched. One complete rotation of the tube will move the contact point the full length of the ruler, and represents one scan line when electrolytic paper is pulled slowly at right angles between this point of contact.

Construction Details

Construction may follow many forms. The box may be made of Masonite as in my APT readout apparatus, or in a 10.3 x 12.9 x 15.4 cm (4 x 5 x 6 in. Bud #CU-729-B) steel box as in the Fast Facsimile readout. The paper compartment or humidor could be in a plastic box with a slit for paper exit at an appropriate level and the mechanical printing complex arranged outside on suitable supports. The sole requirement in such case would be that the paper must not dry out while passing from the slit to the printing blade/helix combination – not probable at a rate of 6.5 cm in 8 seconds, but a situation to be reckoned with, nevertheless, where interpicture waits take place.

If the cabinet is to be made of Masonite one may well use 0.7 cm (¼ in.) tempered Masonite held together by 4-40 machine screws 2 cm (¾ in.) long, screwed into holes drilled to the exact original diameter of the screw. To further firm up the cabinet, the screws should later be individually removed,

"Will-hold," "Glue-bird" or "Elmer's" glue placed in the hole, and the machine screws again screwed into place.

In the metal box of the fast fax readout, the partition was placed at the approximate midpoint with the slit for the paper 2 cm (¾ in.) from the top. Both the top and the bottom of the cabinet were removed and cut so that one portion of each covered the paper compartment. The bottom cover was then attached permanently with self-tapping screws and epoxy cement. The support for the paper was fashioned from two galvanized angles, two arms of which were superimposed to form the base of a U-shaped bracket. A drill and hacksaw aided by a rat-tailed file enabled the formation of the necessarily slanted holes for the reception of the alfax paper spindle (Fig. 1).

An area approximately 9.6 cm (3 x ¾ in.) deep was cut from the upper front area of the front of the metal cabinet with a nibbler, and a 1.3 cm (½ in.) width of 0.65 cm (¼ in.) plexiglass was bolted in so as to leave a 0.65 x 7.7 cm (¼ x 3 in.) slit for the printed paper to pass out to the paper puller.

One of the two compartments of the cabinet is a "humidor" for the maintenance of the wet paper. The other is the printing chamber. The latter was originally planned as a humidified chamber, but this has been found unncessary and seems undesirable, as the humidity might affect adversely the metal components of the printing complex. The humidor, whether made of Masonite or in a steel box, was first water-proofed with two coats of marine fiberglass paint (epoxy resin – not monoepoxy) as was also the printing compartment. After these coats had set, the paper compartment was given an additional coating of hot paraffin because it was found that water in the bottom caused the questionable grade of epoxy to turn white. The top of the humidor was made of plexiglass (or the original metal cover) held firmly in place by removable screws. Some sort of device must be included to prevent paper runaway. I wedged felt brakes at the ends of the spool in my APT model, which kept the spool tight enough to prevent runaway but loose enough to permit the paper puller to keep the paper flowing without variation. The device indicated in Fig. 1, made of a 2.54 cm (1 in.) width of shim brass, was used for this purpose in the fast fax readout.

The upper part of the central partition above the paper slit is made of plexiglass, as is also the lower portion, and is held in place to the walls with brass angles. This upper portion of the partition in turn becomes the support for the blade electrode supporting shelf, which is held firmly in place just above the paper entrance in the printing chamber by two small brass hinges on the upper side of the 0.65 cm (¼ in.) Masonite or plexiglass which supports the blade electrode exactly above the center of the drum.

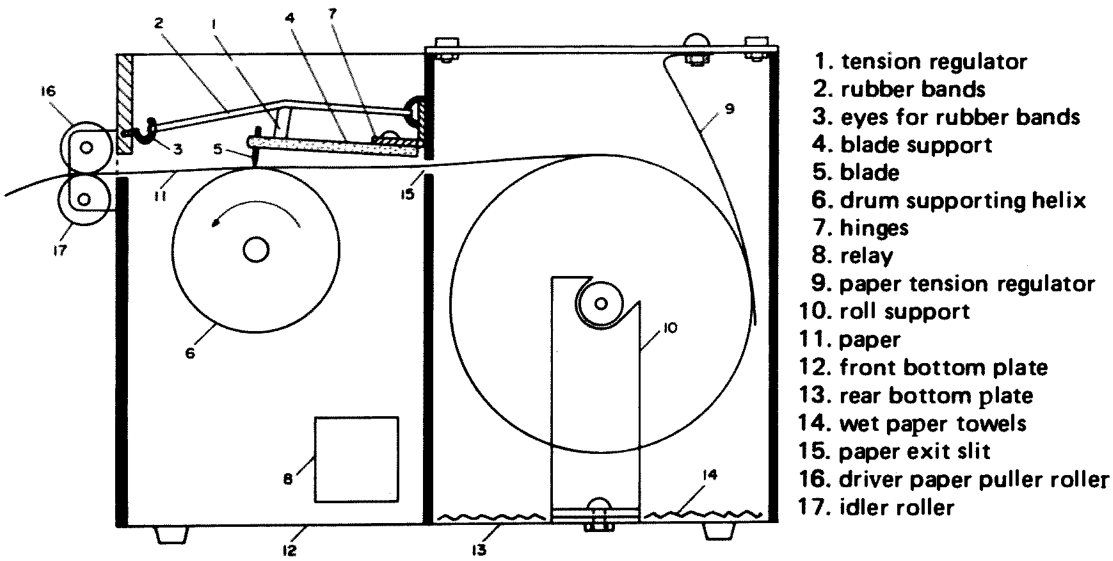
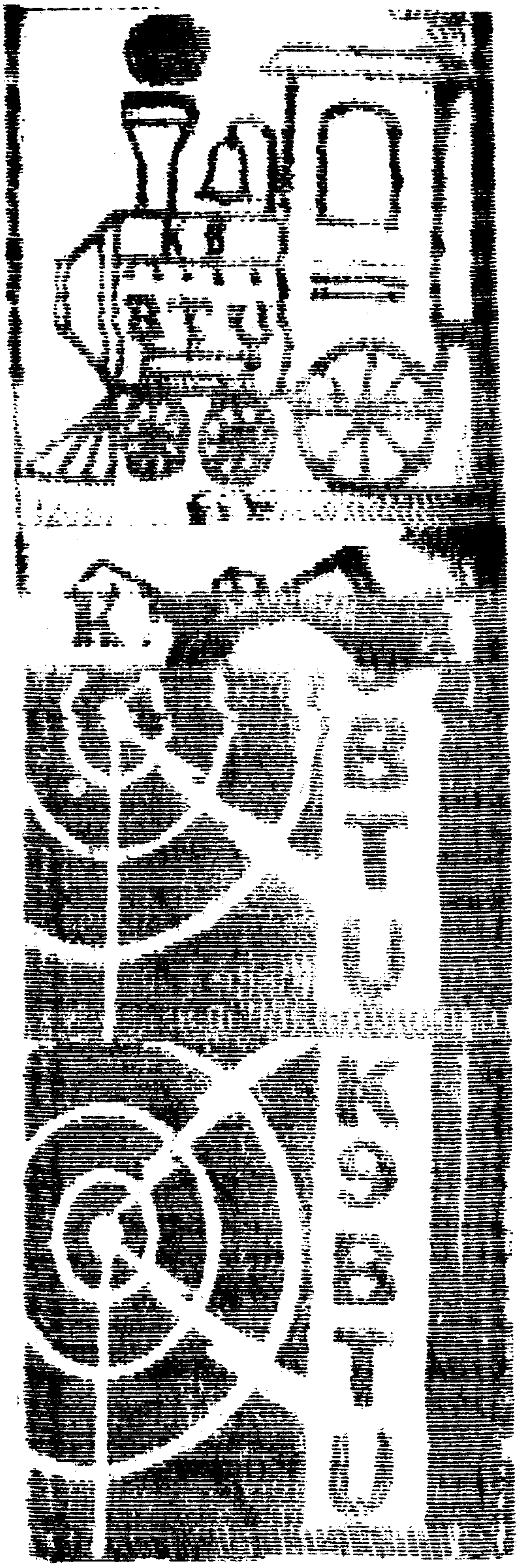


Fig. 1. Diagram of the mechanical layout of the Fast Facsimile recorder.



Facsimile QSL received from K9BTU while reading the mail on SSTV. Since the machine is a direct recording device, all signals received are processed. Note the array of partial frames below the first picture.

The printing blade is a 1.3 cm (½ in.) strip of stainless steel three inches long fastened to the edge of the 3.9 x 5.2 x 0.65 cm (1½ x 2 x ¼ in.) plexiglass blade support. 0.3 cm (1/8 in.) holes are drilled into the edge, duco cement inserted, after which 4-40 machine screws were forced in. After a few minutes these were removed and the cement was allowed to dry. This in effect threaded the hole. The blade was attached by these same machine screws threaded into the holes. The blade rests on the top center of the helix. Desired levels of residual tension are applied to the shelf by several rubber bands originating above the point of hingement and extending to the front of the compartment. These are held in place at both ends by small hooks, and tension is maintained and varied by a strip of 0.65 cm (¼ in.) Masonite or plexiglass held passively in place between the hinged blade support and the rubber bands. Considerable tension is necessary in order to print smoothly on the paper; however, too much tension results in paper shredding and cutting.

The drum should be of insulating material about 3.9 cm (1½ in.) in diameter. There is nothing sacred about this size, however, and available materials should dictate. End pieces with exact centering should be turned from most any available material. I used fiber glass obtained from war surplus items throughout, and cemented them with epoxy. The length of the drum is controlled by the width of the paper decided upon. The most logical size of paper is 7.1 cm (3¾ in.) wide and was chosen to take advantage of the $1.50 price break between this and the next larger size. The drum length was a little over 9 cm (3½ in.) and the spiral helix occupied a total length of 6.8 cm (2 5/8 in.).

The spiral helix was made of #22 nichrome wire bought from a laboratory supply house. Any relatively nonstretchable wire of equivalent size and behavior may work equally well providing it does not rust and is not reactant with the chemical in the paper.

The drum must turn in the counterclockwise direction observed from the (right) end, while the spiral must be made clockwise as indicated in the diagram. This is an essential

feature for correct picture orientation. The wire is passed through a short diagonal hole to the end of the drum, where it is anchored to the end with a self tapping screw. It is then pulled tight, arranged in position on the drum where it is caught in the strong grip of a husky pair of long-nosed pliers. By twisting, the wire is tightened and the end then secured around a second self tapping screw. One end must eventually be connected electrically to the 0.65 cm (¼ in.) shaft which serves as the drum axis. The center of the helix must be exactly midway between the origin and insertion of the two ends and on the opposite side of the drum. It should be tight enough not to require cement to hold it in place.

The ball-bearing assemblies which support the drum are mounted in the two ends of the cabinet at a position dictated by the location of the other active components of the printing chamber. In the metal model the bearings were cemented in holes in small pieces of Masonite with epoxy cement, and these were then bolted in the appropriate position inside of the cabinet. The holes receiving the ball bearings must be immediately below the printing blade and so positioned that the top of the helix is on the same level as the paper intake and exit slots. The bearings should be snug and tight. They may be held firmly in place in Masonite models by drilling a small hole beside each and then inserting an overlapping machine screw and tightening it firmly with a nut. The spring blade from an old relay riding against the shaft provides the electrical connection to the spiral wire of the helix.

The drum motor is the Bodine KYC-23, 3500 RPM synchrons, 9.5 watt job used in several industrial applications. They are available as industrial surplus from Herbach and Rademan, Inc., 401 East Erie Avenue, Philadelphia PA 19135; current price $4.95. This motor requires a set of gears to give a 4:1 speed reduction from 3600 RPM to 900 RPM. Suitable items are Pic Design Corporation's G 57-12 along with their G 41-48, which will give the required 15 RPS or 900 RPM. Their address is P.O. Box 335, Benrus Center, Ridgefield CT 06877. The price currently is $11.70 plus postage and tax which should be included with the order.

The same supplier as for the Bodine motor has numerous synchronous motors at 1800 RPM. These might be substituted with a 2:1 gear reduction system. Hurst also makes a 900 RPM motor which would obviate the gear problem, but the price is prohibitive in most cases and the motor is larger than needed.

The drum motor is mounted on the right hand end of the printing compartment. The Bodine motor is supported by three of the four mounting bolts, the originals of which have been replaced with 6.4 cm (2½ in.) replacement bolts and spacers. The fourth position allows the large gear on the drum shaft to reach the small one on the motor shaft.

The paper puller assembly uses a 3 watt synchronous motor turning at 15 RPM, which with the described rubber rollers give the desirable square picture for an 8 second frame. Any other 3 watt synchronous motor of appropriate speed would probably work, though the motor is working very near its maximum capacity and a Hurst 10 watt model CA might be more desirable.

The paper puller consists of two lengths of 0.5 cm (3/16 in.) brazing rod covered with 7.7 cm (3 in.) lengths of rubber tubing. If these perimeters are changed, then the motor speed must also be altered to maintain the correct speed of paper advance. The brass rods are supported either by brass angles or brackets. It is desirable but not mandatory to turn the rods down at the ends to fit 0.3 cm (1/8 in.) holes in the respective brackets. I used appropriate sizes of spaghetti as coupling to the motor.

The position of the motor was dictated by the position of the paper exit slit and the direction of motor rotation. The top roller is driven when a clockwise motor is used on the left end, while the lower rod must be driven under the same conditions if a counterclockwise motor is used.

This paper puller motor must run from the light mains, but must never be in operation when the drum is turned off and tension is applied to the paper by the printing blade. After several times tearing up the paper, I prevented a recurrence by turning off the paper puller and the video input to the blade electrode with a 110V ac

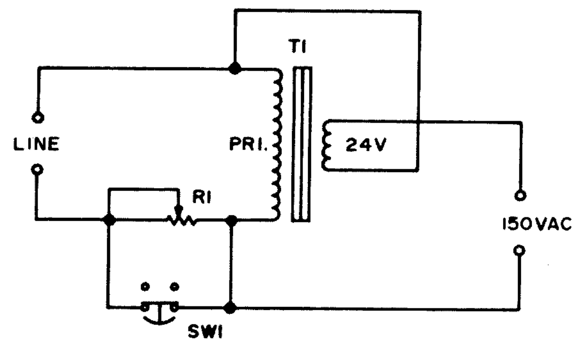


Fig. 2. Autotransformer to raise line voltage to 150 volts to obtain good synchronization from the Bodine motor. R_1 should be adjusted so that when SW_1 is pressed the motor is only slightly slowed.

relay energized by being connected in parallel with the drum motor. Thus, whenever the drum motor supply turns off, the other two functions are also stopped.

Synchronization

It goes without saying that the 60 Hz ac controlling the drum motor must be synchronous to that controlling the camera, the flying spot scanner, or the drum at the transmitting station. This condition is usually true within the continental United States and Canada, but is not when a tape recording is being used at the sending end, nor is it true with most foreign countries. 60 Hz will not necessarily be in sufficiently perfect sync to print out pictures though I have received successful pictures from wide areas of the country simply by running the drum motor from the ac line. This does not mean they will be framed correctly. Framing may be accomplished by momentarily reducing the ac voltage on the drum motor until sync is lost, which allows the drum to lag until framing is accomplished. For good sync, the voltage on the drum motor should be around 150 volts. This may be obtained from the ac line by connecting a 24V filament transformer so that it operates an auto transformer (Fig. 2). The secondary must be reversed if the resulting output voltage is less than line voltage.

If the pictures are to be tape recorded before being printed out, then a dual track recorder is necessary. On the left track the 60 Hz line is taped simultaneously with the received slow scan signal on the right track. If the two ac lines are synchronous, then the picture will be synchronous for any later printout. When thus printing out from a tape a 15W, 60 Hz ac amplifier or equivalent must be used to drive the motor from the left track of the tape recorder simultaneous with printout from the right.

A much better and more versatile system, however, is the tunable frequency standard. This consists of a very stable variable frequency oscillator such as a unijunction or voltage sensitive integrated circuit as shown in Fig. 3, operating at, say, 60 kHz, which is then "counted down" to 60 Hz with three decade counters, such as the SN7490s which are presently so inexpensive on the surplus market.

The 60 Hz obtained from the countdown is square wave and must be turned into sine wave, since the Bodine and Hurst motors definitely object to square wave. This is done by feeding the output into a 15H choke as inductance resonated at the output end by a condenser to ground. The junction

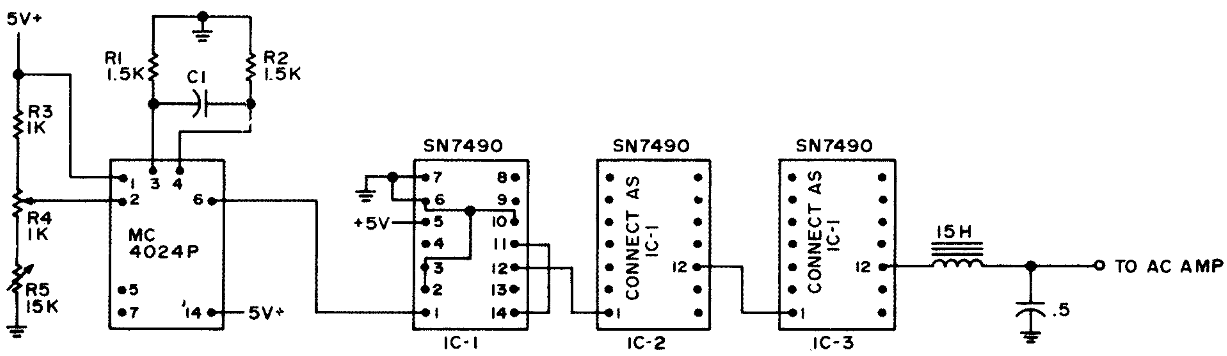


Fig. 3. The variable frequency synchronization system worked out by W6KT for his SSTV monitor, modified for use with the fast fax. R_1 and R_2 limit the range while C_1 and C_5 are used to set the frequency for exactly 60 Hz with R_4 at midscale.

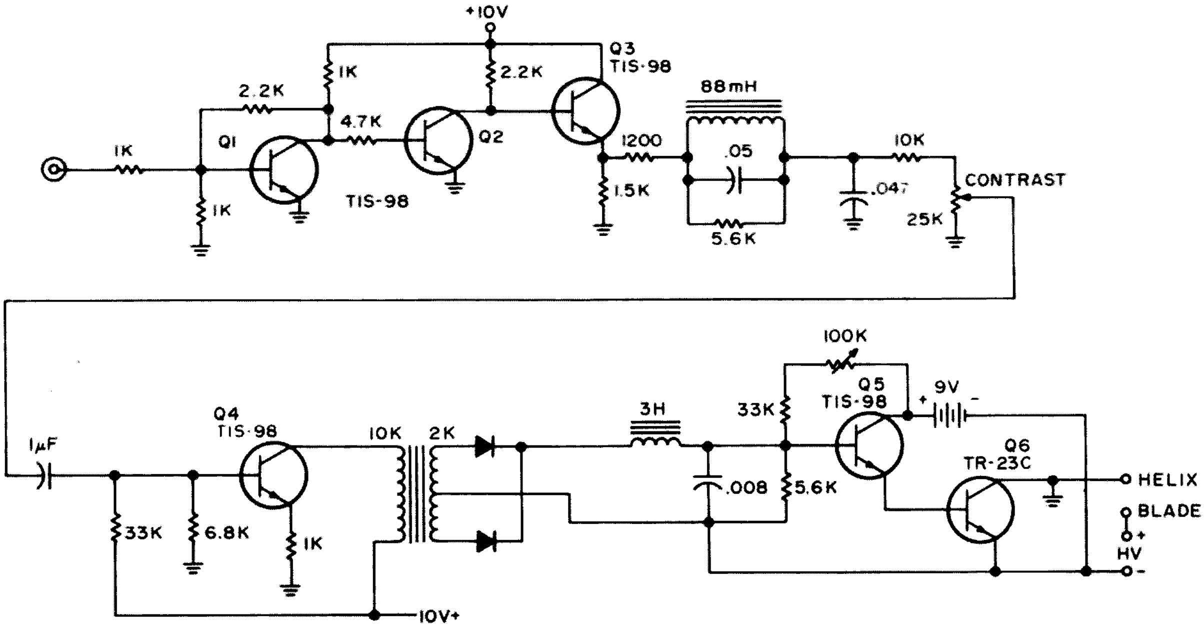


Fig. 4. The video circuit consists of the hard limiter Q_1-Q_3 and a conventional McDonald L/C discriminator. This is followed by an amplifier, a rectifier, filter and the paper marking amplifier. Some of the former circuits may be eliminated by use of the video circuits of a conventional SSTV monitor, in which case one would probably connect in at the contrast control.

of the choke and condenser shows perfect sine wave and is ready for amplification to the 150V at which the motors hold synchronization best. When the voltage on the motor drops below 130V, various synchronization anomalies begin to occur.

If carefully constructed, this makes a very stable standard which can be adjusted to exact synchronization with the received signal, generally even when ac operated tape recorders of the better types are used at the transmitting end. Replacement of a tape recorder motor with a synchronous one would probably be near optimum. Little can be done with the signal from the dc operated cassettes.

Of course, the ideal system would be for everyone to have absolute 60 Hz power to run their frequency sensitive apparatus. A standard frequency obtained from a crystal at, say, 6 MHz and divided down to 60 Hz by decade counters is extremely stable and probably represents the optimum. Briefly, the signal from a 6 MHz oscillator is fed at low impedance successively through three sections of a hex inverter to produce a square wave. This squared 6 MHz wave is then fed into five decade counters successively, coming out at 60 Hz. To improve the level it then goes into the last three sections of the original hex inverter. What comes out is square wave and the previous remarks hold in this arrangement as well.

In order to set the signal of the 6 MHz crystal to exact frequency, some signal from the crystal oscillator must be taken through a "divide by six" integrated circuit to give 1 MHz output. This should then be used to zero the oscillator with WWV at 10 MHz.

Video Circuitry

The video circuit feeding the blade and helix are shown in Fig. 4. It consists of a hard limiter feeding the classic SSTV discriminator introduced by McDonald. The output of the discriminator is fed to a transistor amplifier which is a transformer coupled to the demodulator diodes. These are connected to give a positive output, which then drives the Darlington paper driver amplifier. The whiteset potentrometer sets bias on the Darlington and thus should be adjusted to the threshold point with no signal. Black level is set by the contrast control. These perimeters are the opposite to those of the usual SSTV monitor. The paper marking voltage should be of about 40V dc

"Peeping Tom," an intriguing fax picture, even though the window is obscured by QRM.

shunted with 200 μF of electrolytic capacitors to guarantee the high current capacity required during printing. Hard control of the voltage is necessary since the current varies from zero to 200 or even 300 mA. Be absolutely sure there is no ac hum in the power supply.

Notes on Operation

When operating the fast fax, unless you have a variable standard you should note if the transmitting station is sending live copy. If he is not, or cannot do so, there is little use in attempting picture exchange. The signal is tuned in on normal voice, the motor is turned on, the contrast adjusted to produce copy, after which the margin is adjusted by the momentary loss of sync button (Fig. 3). The pictures should then roll out into your lap at an unnerving rate. Fortunately, experience will cure this initial adverse effect.

The printing surface of the blade requires frequent care. After every run when putting the fax away the blade should be lifted and the surface cleaned with water, and perhaps

The skew in this fax picture was caused by a tape recorder at the transmitting end.

also with emery cloth. This will prevent a smudgy appearance when collected pigment accretions begin behaving as crayons.

As normal printing occurs, the blade deteriorates due to the necessary electrolysis which bleeds off positive iron ions into the paper. The iron ions unite with the chemical in the paper to produce the mark. After a time the blade may become uneven. Such a blade may be rejuvenated by grinding on a perfectly flat carborundum stone until any bumps are removed. The degree of printing deterioration determines the necessary frequency of this operation.

Threading the paper is a bit of a chore. Perhaps the simplest way is to expose the end until it dries, then glue on a thin strip of 12.8 x 17.8 cm (5 x 7) card to use as a "needle."

Pictures are considerably improved in appearance if they are ironed with "cotton heat" just before they are completely dry. They should feel dry to the fingers but still contain considerable water. When allowed to dry too much, the ironing will tend to wrinkle the paper.

In use, I place paper towels in the bottom of the humidor compartment which are then saturated with water to keep the paper from drying out. Each time when beginning a run a length of paper left in the front printing compartment will have dried out. This must be pulled out until the rollers make contact with the wet paper. The paper pulls easily when the dry is between the rollers, and it will slip until it is in contact with wet paper.

Electrolytic printing paper is available from Alden (Alfax Paper and Engineering Co., Inc., Westboro, MA 01581) in single roll quantities; there are several kinds to choose from. I have found the Alfax A-2 to be most satisfactory. Alfax A2-41 gives much better depth without gamma correction circuits, operates more smoothly, and prints in black and white, but unfortunately fades and discolors in time. Alfax A paper is more sensitive, but does not make the clean, crisp picture that the A-2 paper produces. It requires 50% more drive from the video circuits.

Much improvement is yet to be made in the video circuits, the type of paper used, as well as in other parameters of the circuits and mechanics. Only the basic circuits and mechanics are presented here as an invitation to improve and perfect the system.

Appreciation

I wish to especially note the contributions to this article of Virgil Neher W6KT, a fellow APT weather satellite enthusiast, with whom the various circuits were regularly discussed. Many of his ideas are incorporated into the design, particularly of the supportive circuitry, and without him the final form would have been much different if it had ever been brought to fruition.

. . .W6WMI

**Please enclose an SASE with all inquiries.*

References:

[1] McDonald, A new narrow band image transmission system. Part 1. *QST* August 1958. Also: An improved system for slow scan image transmission. Part 1. *QST* January 1961.

[2] Anderson, Amateur reception of weather satellite pictures transmission. *QST* November 1965.

[3] McNight, Evolution of an amateur weather satellite station. *QST* April 1968.

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THE EASY WAY TO SIX AND TWO METER HIGH POWER

Having built a few power amplifiers, I have learned via the school of hard knocks of the almost unavailability of those goodies known as high-power parts. These include meters, transmitting tube sockets, transmitting tubes, switches, blowers, large transmitting capacitors and heavy-current centertapped filament transformers.

After collecting all the parts, then there is the problem of finding a suitable cabinet enclosure, drilling a chassis and cutting meter holes in those 1/8 in. steel rack panels.

The amplifier described here solves all of the headaches described above, as it is ready-made and on the surplus market for $25.

The unit is the Signal Corps AM-8D/TRA-1 FM Amplifier, and with the addition of two fixed capcitors, will operate on either six or two meters FM. Unmodified, it covers the range of 70–100 MHz with a power output of 200W. It measures 10½ H x 16 W x 11 D in. and is not too large for the average table. The schematic is shown in Fig. 1.

The finals are a pair of 4E27/8001s in Class C usable on FM. Bear in mind that the 200W rating is because the 4E27s have a frequency cutoff of 75 MHz and must be operated at a reduced rating above that frequency. 1 kV is used on the plates above 75 MHz and 2.5 kV can be used on six meters, for a power output of 600W.

The panel meter reads 0–30 mA grid drive, 0–600 mA plate current and 0–3000V dc for the high voltage. One percent resistors are used for the various meter shunts.

The panel meter has a clear plastic protective cover, which should be removed if you want to see the meter. It was probably clear in 1950, but mine wasn't. On the opposite side is another meter hole and plastic cover. It probably held an rf ammeter which is missing. This plastic cover was left in place to keep the chassis pressurized.

The squirrel-cage blower is used as an exhaust and blows air *out* of the cabinet – right in your face! The blower can be turned around to blow cool air on the finals, however. A mesh filter is mounted over the intake opening on the chassis and a spare filter is mounted on the other side. As is, the cabinet is pressurized, although copper screen wire is needed to TVI-proof the intake and exhaust openings.

The unit has a hinged top cover, high voltage interlock switch, two very nice pilot light assemblies, three OD3 VR tubes, 5V CT, 15A filament transformer, 12V dc antenna T-R relay and SO-239 standard antenna connectors. The blower and filament transformer alone are worth more than the price of the amplifier.

For conversion to six meters FM, add two 10 pF 6 kV capacitors in parallel with the plate tank capacitor. For two meters FM, add two 35 pF 6 kV capacitors in series with the plate tank capacitor. See Figs. 2 and 3 for this modification.

The Signal Corps manual for this unit is TM 11-2601, should further information be desired.

The chassis-mounted thermostat should be jumpered or removed, as after two hours

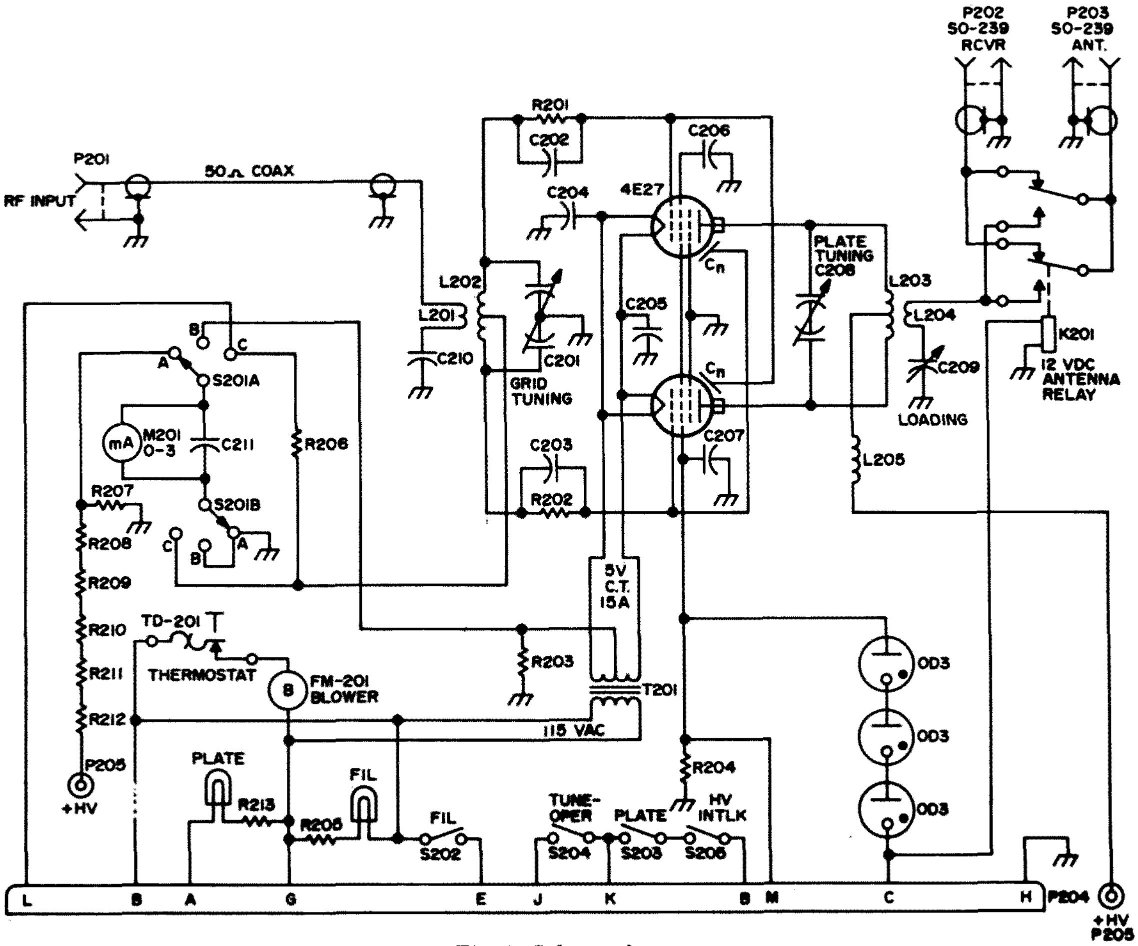

Fig. 1. Schematic.

Table I: AM-8D/TRA-1 Parts List

CAPACITORS:
C201 3–50 pF dual variable
C202-C205 .005 mF 1 kV
C206-C207 .002 mF 1 kV
C208 7–35 pF dual variable
C209 5–50 pF variable
C210 25 pF 1 kV
C211 .002 mF 1 kV

RESISTORS:
R201, R202 10K, 4W
R203 .15 ½W
R204 500K 1W
R205 600 4W
R206 2.5 ½W
R208-R212 200K 2W
R213 600 4W

COILS:
L201 grid coupling
L202 grid tuning
L203 plate tuning
L204 antenna coupling
L205 plate rf choke

PILOT LIGHTS:
PL201, PL202 115V, type S6

CONNECTORS:
P201 rf input
P202 Receiver antenna coupling
P203 Antenna coupling
P204 External power
P205 High voltage

SWITCHES:
S201 Meter circuit selector
S202 Filament ON-OFF
S203 Plate ON-OFF
S204 Tune-operate
S205 High voltage interlock

RELAY:
RL201 Antenna transfer, 12V dc

TRANSFORMER:
T102 Filament, 5V CT 15 A

EXHAUST FAN:
FM201 Squirrel-cage blower, 115V ac

THERMOSTAT:
TD201 Blower control

METER:
M201 0–3 mA dc

TUBES:
V201, V202 4E27/8001
V203-V205 OD3/VR-150

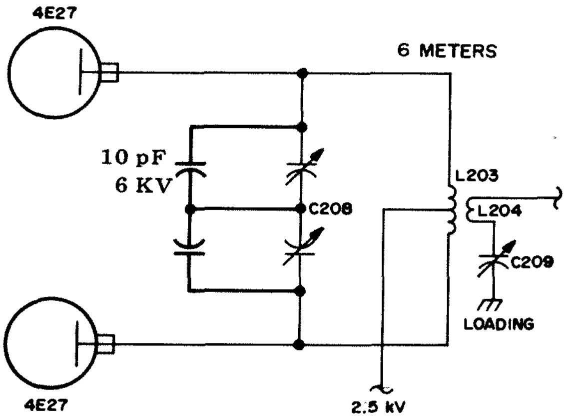

Fig. 2. For 6 meter operation, modify plate only, by adding (2) 10 pF capacitors in parallel with C208, as shown.

mine never did turn on the blower. The blower when running is very quiet, anyway. The blower is on an adjustable mount and should be slid away from the side of the cabinet as far as possible to increase the air flow through the unit.

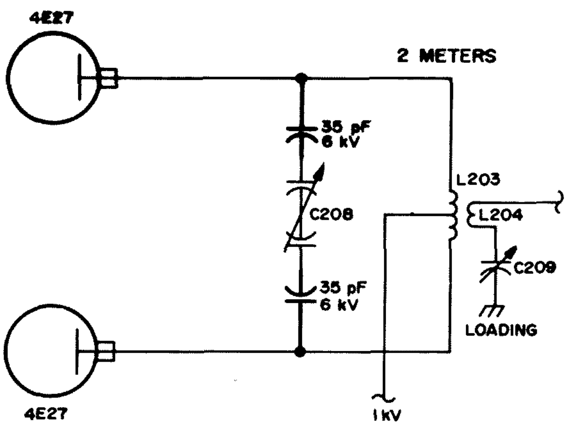

Fig. 3. For 2 meter operation, modify plate tank only, by adding (2) 35 pF capacitors in series with C208.

If you're worrying about replacing the finals in the far future, be advised that 4E27s were going for $1 each at a recent Florida hamfest.

The 2½ turn plate tank is silverplated, and if it is tarnished, it can be cleaned bright again with your XYL's silverware polish.

Should you desire not to put the unit on six or two meters FM, extensive reworking will yield a 80–10 meters CW kilowatt in Class C.

. . .K4EPI

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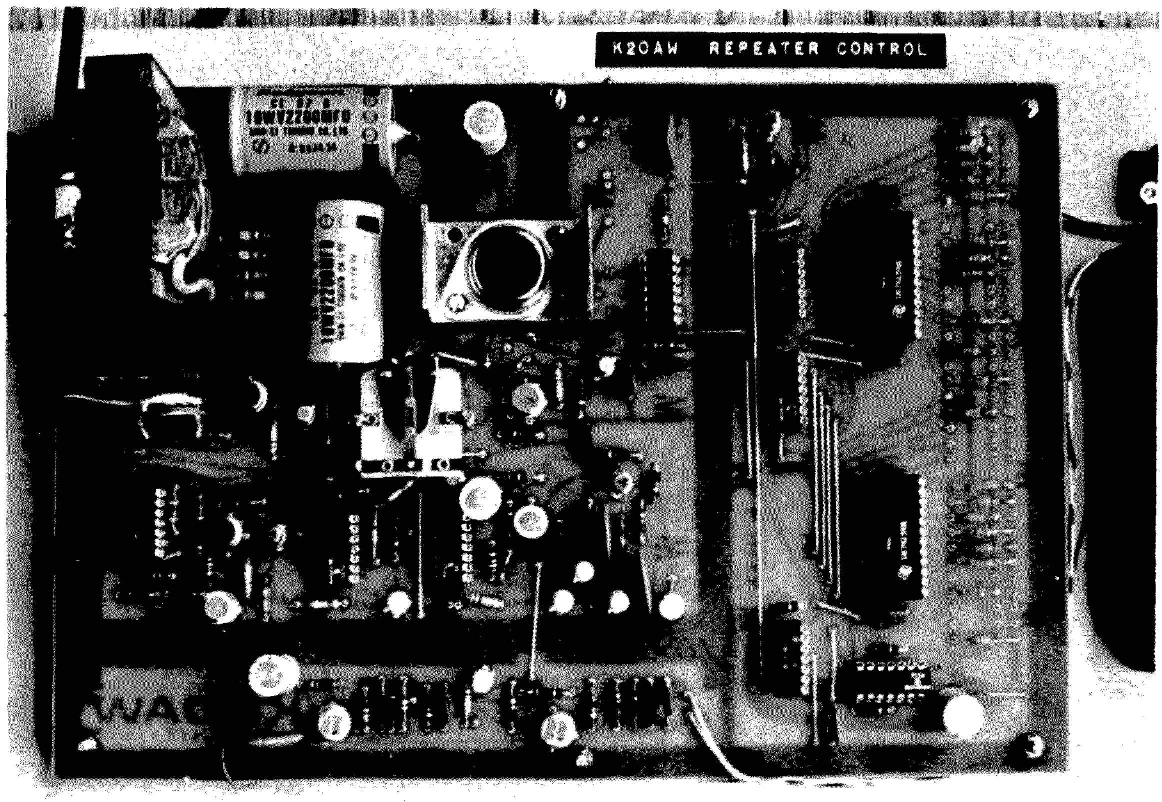
SOLID STATE REPEATER CONTROL

A short time ago we presented our integrated circuit CW ID generator, and promised a solid state repeater control to go with it. In this article we describe two such controls, a simple one for use without the ID and one for use with it. Both circuits make use of the 741 operational amplifier as a comparator relay driver, and you might want to review our earlier article on COR and tone decoder circuits using this IC – ("741 Op Amp COR and Tone Decoder Circuits," *73* Magazine, July 1972, page 83).

Figure 1 shows a simple COR and timeout timer we designed to go with a railroad Motrac receiver. In this receiver Q22 is a noise detector which normally drives Q23, an audio switch which then turns the audio amplifier on and off. The voltage at the emitter of Q22 varies from about +7 volts when fully squelched to about +9.4 volts when unsquelched, but the actual squelch



Repeater control CW/ID.

opening occurs in a narrow range about +9.1 volts. We decided to break the normal squelch at R98, bring out the squelch voltage, process it a bit, and then use the same voltage to drive both the squelch and the COR.

The threshold voltage is set by the 5K pot in the emitter lead of a HEP52 transistor; we decided to set the threshold at about +8 volts. When the squelch voltage drops below this value, this transistor is biased on, which in turn biases on the second transistor. The collector of the second transistor is now at about 0 volts and this voltage is fed back to the Motrac to turn off the audio by turning on Q23. At the same time we get about 0 volts fed to the two diodes in the input circuitry of the op amp.

Since the top end of diode D1 is set at about 0 volts, this diode is turned off and pin 3 of the op amp IC is at about 0 volts. But pin 2 of the IC is slightly positive because of the 220K resistor to +13.6 volts. As a result (see our previous COR article) the output of the op amp IC is near ground, and the relay is open.

Now suppose a signal arrives. The squelch voltage from the Motrac goes above the threshold voltage, and both transistors in the COR are biased off. The audio control voltage going back to the Motrac is now positive, which turns on the Motrac audio. At the same time, the voltage to diodes D1 and D2 goes positive also. After a slight delay, the 10 μF capacitor charges through diode D1 and pin 3 of the op amp goes positive. Since pin 3 is now more positive than pin 2, the output of the op amp goes positive and the relay pulls in.

At the same time, diode D2 becomes reverse biased because its cathode is positive. The voltage at the top of C2, which was close to zero til now, starts rising. After about two minutes this capacitor charges to the point where the voltage at pin 2 of the IC is larger than the voltage at pin 3, and this makes the relay drop out. This gives us about a 2 minute timeout.

When the received carrier drops, the audio control voltage back to the Motrac drops quite fast and mutes the audio. C2 discharges back to near 0 volts through diode D2 to reset the timeout timer. But C1 stays charged for about a second or two, which delays the drop-out of the relay. This prevents excessive keying of the transmitter after every transmission, but it also has another interesting side effect. When the repeater is timed out, it comes back on for a second or so when the received signal drops, to tell the other stations that the timer is reset and the repeater available. In this way

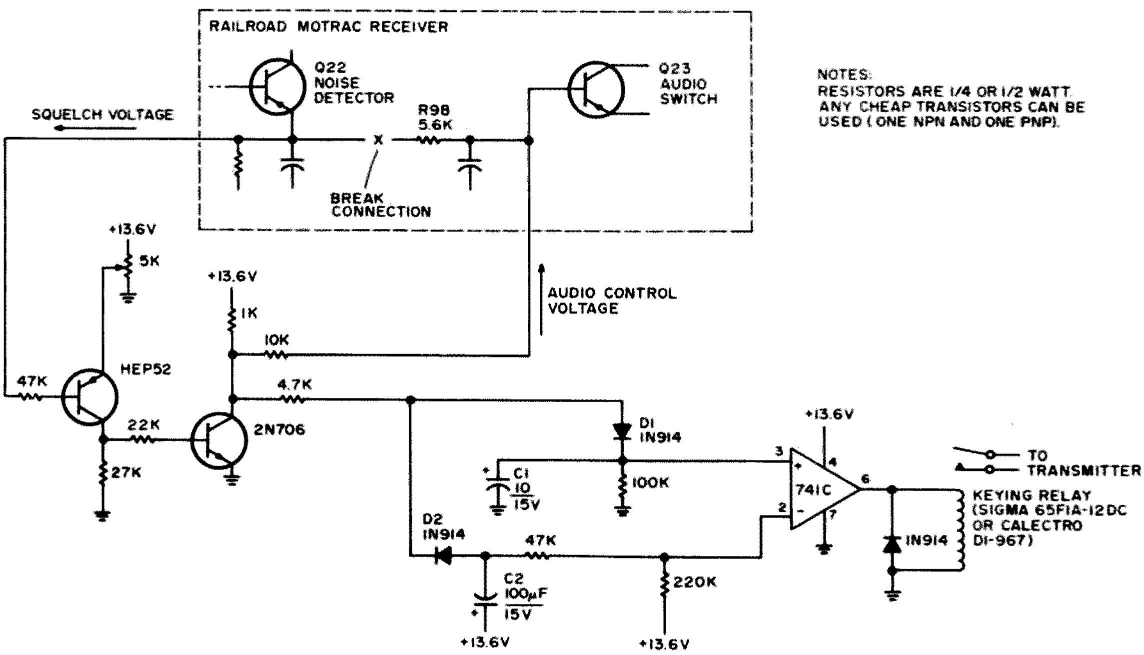


Fig. 1. Simple COR and timeout timer.

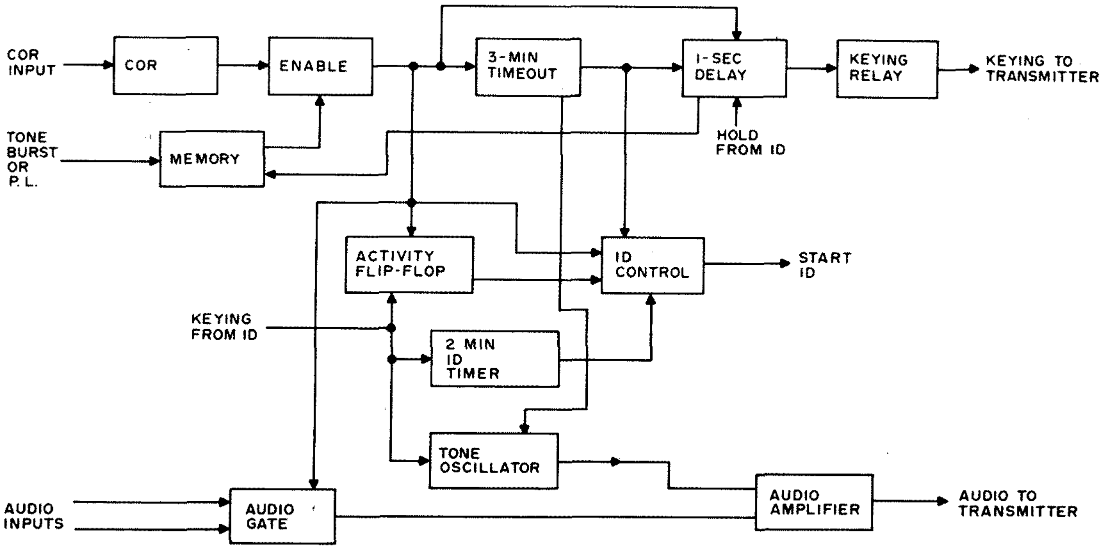


Fig. 2. Repeater control block diagram.

you don't have to keep testing to see whether the machine is available.

The Timeout Timer

The block diagram for a more complicated repeater control is shown in Fig. 2. This one includes a COR designed for tube receivers, memory circuitry for tone burst or PL, a three-minute timeout timer, ID control circuits and timer, and an audio buffer system. Because of its increased complexity, we have designed a printed circuit board for this system.

Figure 2 gives an overall view of the control. The COR at the upper left works in combination with the tone burst or PL memory to energize the keying relay. When the received signal disappears, the one-second delay causes delayed dropout. The three-minute timeout timer releases the relay after three minutes of transmission.

An activity flip-flop keeps track of repeater activity, and causes the ID to start at roughly two minute time intervals as long as the repeater is busy. The repeater IDs under four conditions: at the end of the first transmission in a series; roughly two minutes apart thereafter (though always waiting for the end of a transmission); after the last transmission in a series; and after a timeout. In those repeaters where the ID is desired even when there is no activity, the activity flip-flop can be disabled; in this case the ID will turn on every two minutes.

The tone oscillator generates the ID tone. But it has an input from the timeout timer, which causes the pitch of the ID to fall and then rise after a timeout. This makes it clear to the offender that he goofed.

At the bottom of the block diagram is the audio path. The control provides two audio inputs, one of which is inverted in the amplifier. Thus they can be used to mix two single-ended inputs, or even for a single balanced input. The audio gate is controlled by the COR signal, which mutes the audio as soon as the carrier drops. This causes a very short squelch tail. In this way it is possible to take the audio directly from the discriminator, or else disable the squelch on the receiver. The audio from the audio gate is then mixed with the ID audio in the audio amplifier, and sent to the transmitter.

Figure 3 shows the detailed diagram of the logic and timer circuits. The COR is located in the upper left corner, and uses a 741C operational amplifier. It is designed for a negative-going voltage at the COR terminal, with a threshold lying between +1 volt and about −10 volts, such as you might get from the limiter current test jack of a tube receiver. The COR input is activated whenever the dc voltage at pin 3 of IC3 goes more negative than pin 2. The two resistors connected to pin 2 provide a reference voltage of about +2 volts, and the 100K pot provides an adjustment for the COR level. To adapt the COR input to work with other

input levels you need only change the input connections to IC3. For negative-going voltages the input should go to pin 3 as shown; for positive-going inputs merely interchange pins 2 and 3 of the IC when putting it on the board. Keep the arrangement shown if the threshold is between +1 and −10 volts; replace the 100K resistor with about 22K if the threshold is between +1 and +3 volts, and connect the right end of the 100K pot to ground instead of to +5 volts if the threshold is between +3 and +10 volts. There are many other ways to modify this circuit for other input levels; see our previously cited article on tone decoders and IC COR circuits for more details on how the 741C integrated circuit works.

The output from pin 6 of IC3 is normally at about +10 volts, which reverse-biases the PNP transistor connected to the output. Since there is then no current through the 330Ω resistor, the collector voltage of the transistor is about zero. When a received signal appears, the IC output drops to near ground, which turns on the transistor and makes the collector go up to about +5 volts; this is interpreted as a logical 1 signal by IC7a.

The other input to IC7a comes from a memory flip-flop consisting of IC7c and IC7d. This flip-flop sets each time the TB (external enable) input is grounded, providing a logical 1 signal to pin 2 of IC7a, and resets each time the keying relay drops out. The TB input has to be grounded at the beginning of a transmission or else the keying relay will not come on. If the repeater is an open machine requiring no access tones, then simply ground the TB input. Otherwise it may be connected to a tone burst decoder (which has to have a relay contact to ground or else an NPN transistor to ground), or (for *really* private repeaters) to a Touch-Tone decoder. You may connect a PL decoder here as well. As shown, the flip-flop is connected for just an initial PL tone enable; for continuous tone simply remove the connection between pins 9 and 11 of IC7.

The COR signal, gated with the memory flip-flop output, is inverted by IC7a, IC5d, IC5b, and IC5c, and applied through a diode to a 50 μF hold capacitor and to an NPN transistor which pulls in the keying relay. The capacitor provides about a ½ second dropout time at the end of the transmission.

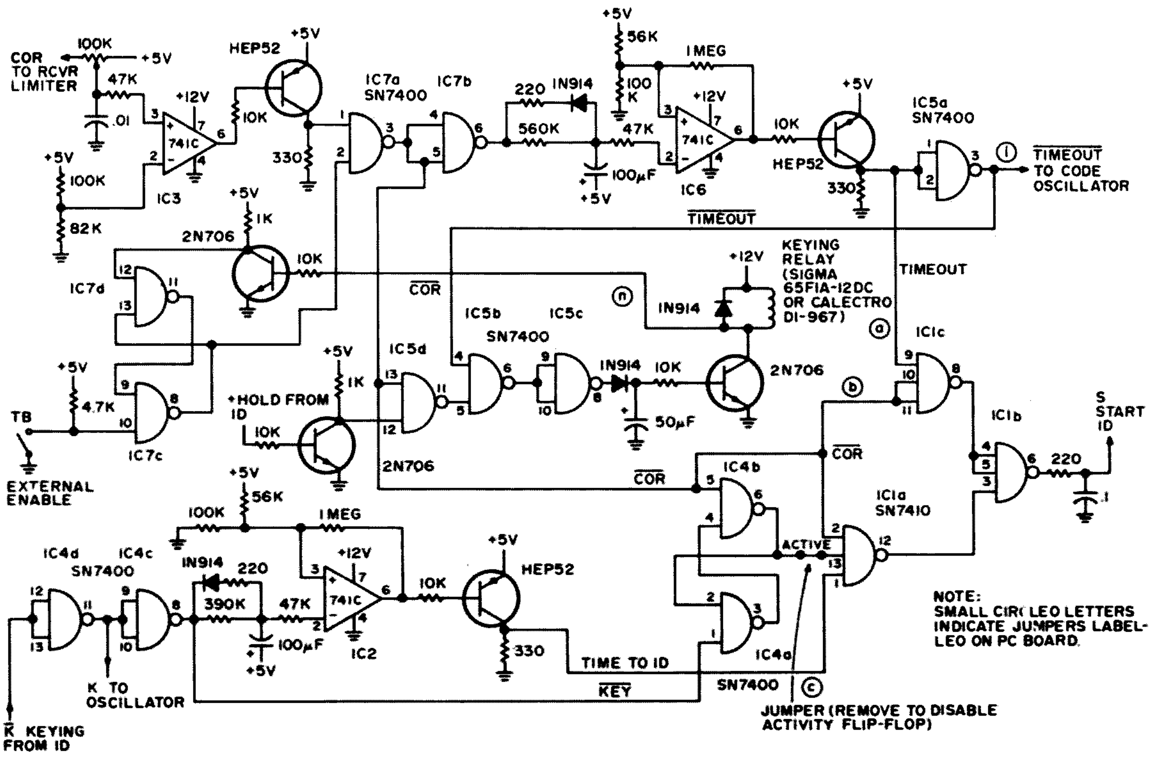


Fig. 3. Logic and timer circuits.

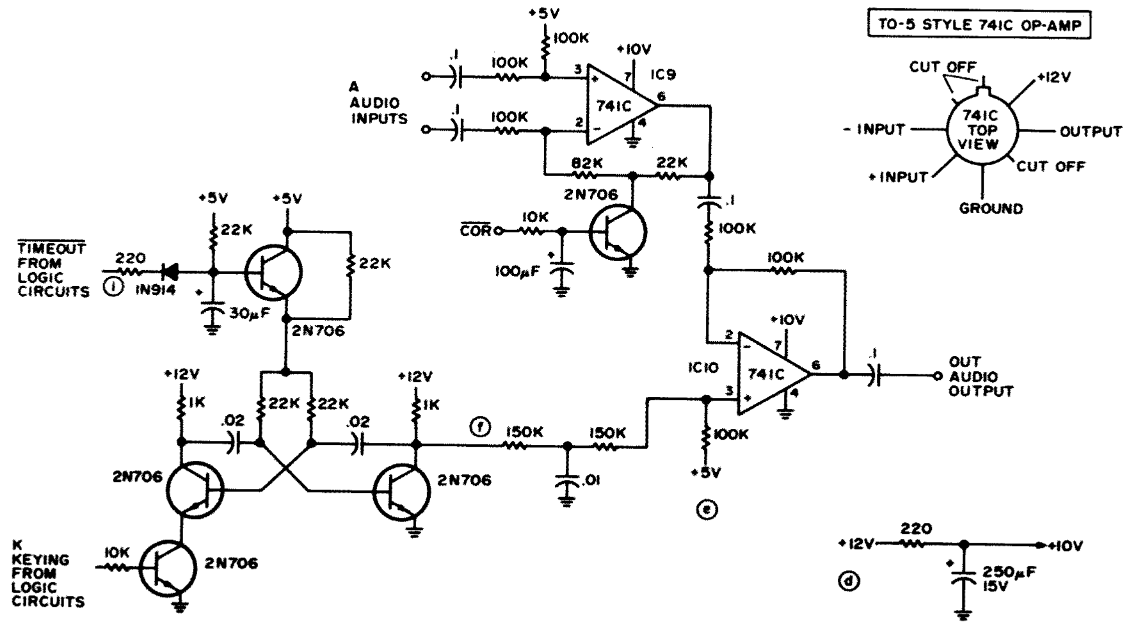


Fig. 4. Tone oscillator and buffer amplifier.

Also applied to IC5 is the hold signal from the CW ID, inverted by a transistor inverter, which keys the transmitter during the ID.

The output of IC7b also goes to the timeout timer. As long as no signal is received, pin 6 of IC7b is near ground, and keeps the top end of the 100 μF capacitor near ground, through the diode. As soon as a signal is received, pin 6 goes positive and starts charging the capacitor through the 560K resistor. After about three minutes (depending on the tolerance of the capacitor – the bigger the capacity, the longer it takes) the voltage at pin 2 of IC6 reaches the voltage on pin 3, and the output on pin 6 swings negative, turning on the output transistor. This generates a logical 1 which goes to IC1c, and a logical 0 which goes to IC5b pin 4, turning off the keying relay. The 1 signal to IC1c starts the ID as soon as the COR disappears after the timeout.

At the lower left of the diagram is another timer, just like the timeout timer but using a 390K resistor instead of 560K. This one provides about a two-minute cycle, which is started every time the ID keys the call. Two minutes later the output transistor generates a logical 1 to indicate that it is time to ID again; this goes to IC1a pin 1.

IC4a and IC4b form another flip-flop, the activity flip-flop. It is set each time the COR is activated, and reset by the keying signal from the ID – thus it remembers whether there have been any transmissions since the last ID. If yes, then the active output line has a logical 1, which goes to IC1a pin 13.

IC1 forms the ID start control logic. As mentioned earlier, IC1c starts the ID when the carrier drops after a timeout. IC1a starts the ID whenever all of the three inputs are logical 1's – that is, when it is time to ID, the repeater has been active since the last ID, and the COR is off, meaning that no carrier is present. This will generally happen when a received carrier just drops, or after the last transmission of a series.

Figure 4 shows the tone oscillator and buffer amplifier. The tone oscillator, at the lower left is just an astable multivibrator which generates a tone at about 1500 Hz. It

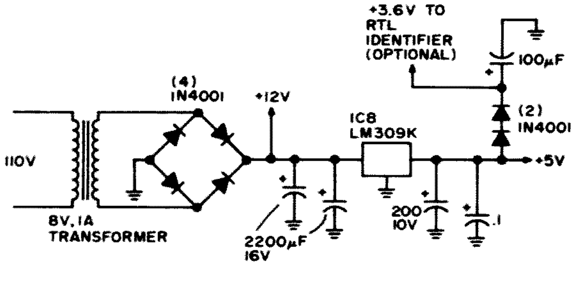


Fig. 5. Power supply.

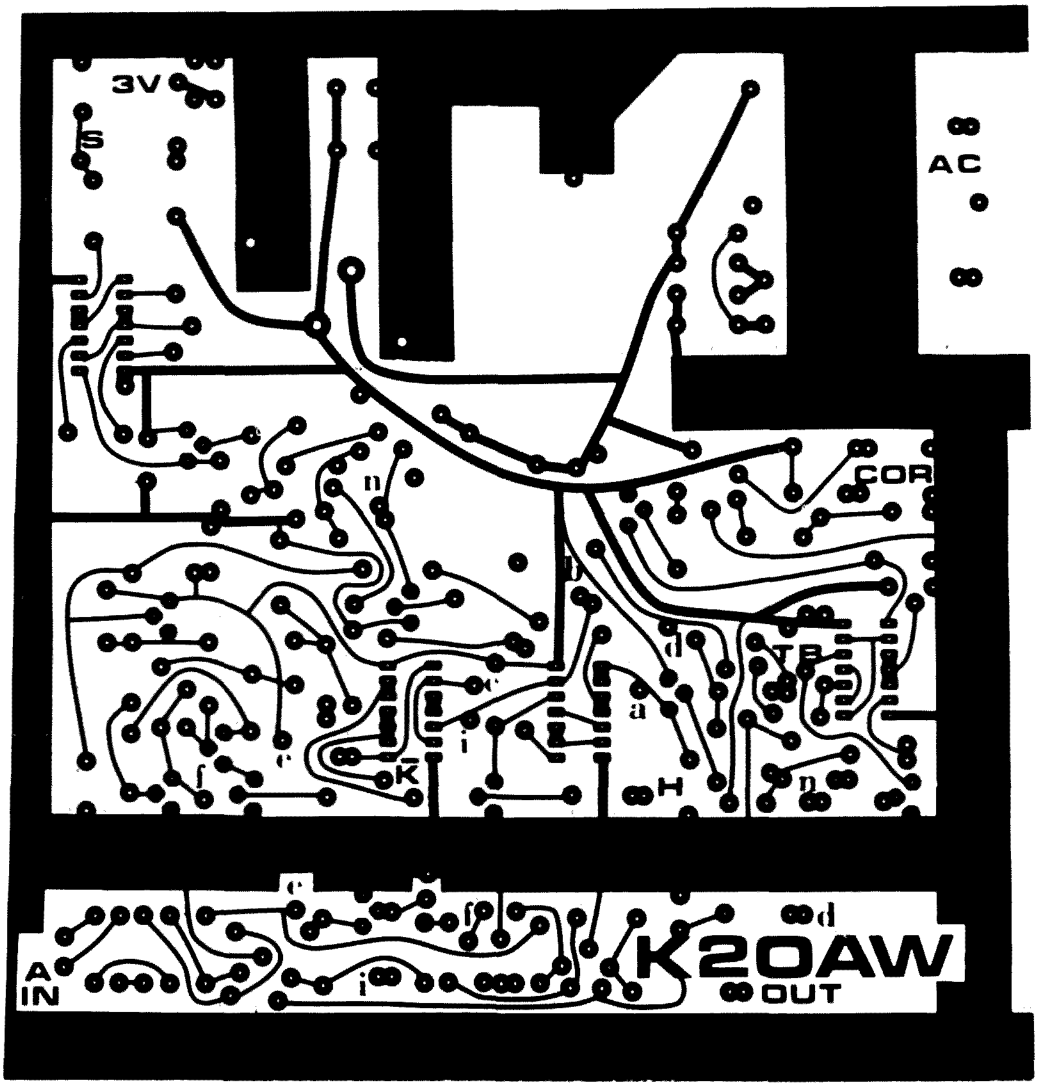


Fig. 6. Printed circuit board layout, repeater control section, 2/3 actual size (copper side).

is keyed on and off by an extra transistor, connected in series with the left-hand transistor of the multivibrator.

The two base resistors of the multivibrator connect to a fourth transistor, which controls the applied voltage. The oscillating frequency depends on the applied voltage. Under normal operation, the top transistor is on and applies the full +5 volts to the base resistors. But when a timeout occurs, the 30 μF capacitor is discharged through the diode, and the voltage applied to the base resistors of the multivibrator drops. As the capacitor is allowed to charge after the timeout, the voltage rises and the oscillator frequency rises back to the normal value.

The square wave output of the oscillator is filtered and applied to pin 3 of IC10, which is the audio output amplifier. Also applied to IC10 is the output of IC9, which is the audio gate.

Two audio inputs, usually coming from the repeater receiver, are connected to the input pins of IC9. With the 100K input resistors and the 82K and 22K feedback resistors, IC9 normally acts as a unity gain amplifier, as long as the transistor connected to the feedback path is open, which occurs only when a carrier is received. As soon as the carrier drops the transistor starts to come on and upsets the dc biasing of IC9 to the point where it just stops amplifying. This then cuts off the audio.

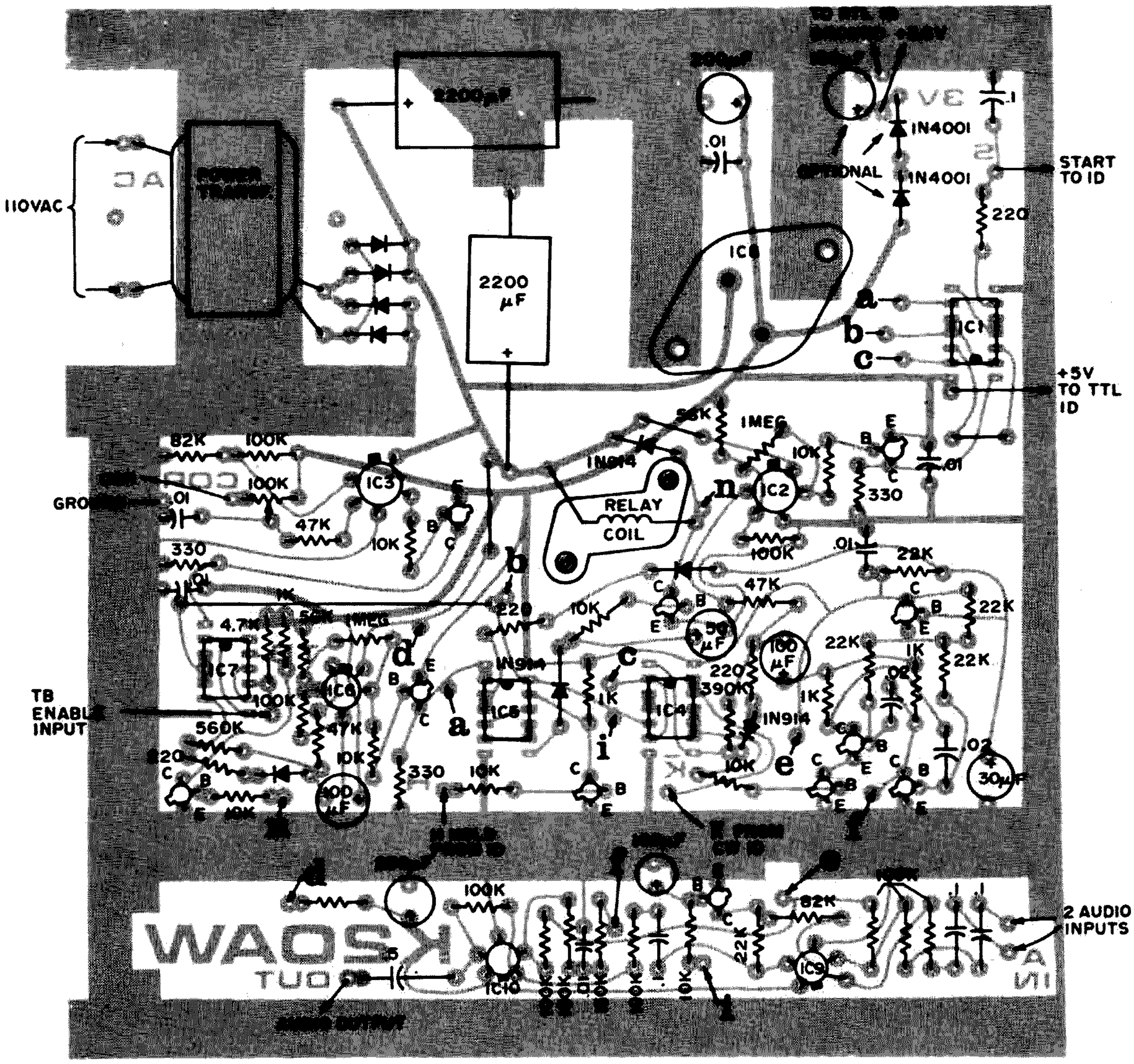


Fig. 7. Parts layout (component side).

The power supply is shown in Fig. 5, and contains a simple full-wave bridge rectifier, capacitor filtering, and +5 volt regulation with IC8. If an RTL CW ID is used which requires about +3.5 volts, then the addition of two diodes and a filtering capacitor will give about +3.6 volts.

The repeater control shown can be used with either the RTL ID described by W7PUG in *73* Magazine in September 1970, or with our own TTL design, referred to earlier. If the RTL ID is used, you will have to add the two diodes and capacitor shown in Fig. 5, and bypass IC4d, shown in Fig. 3. This is because IC4d is used to invert the keying output from the TTL ID, while no such inversion is needed with the RTL ID. To disable IC4d, simply clip off pins 11, 12, and 13 of the socket which holds IC4, and run a jumper between pins 11 and 12.

All the parts in Figs. 3, 4 and 5 fit on one printed circuit board, shown in Fig. 6, which is roughly 7 x 7 in. The TTL ID referred to previously is about 3 x 7 in., and the photographs show both the ID and the control. The two can be placed together on one 7 x 10 in. board as shown, or placed on separate boards.

Figure 7 shows the actual parts placement on the board. Board layouts are available from the author if you send a SASE; etched boards and parts will also be available from *Circuit Specialists, Box 3047, Scottsdale AZ 85257.*

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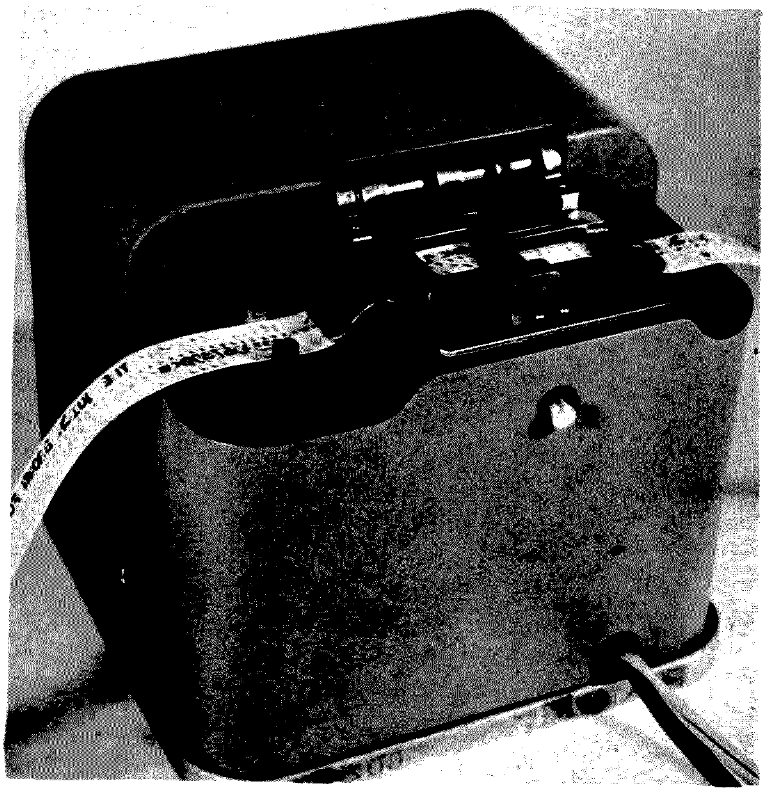

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A DIGITAL TAPE DISTRIBUTOR FOR RTTY

This tape distributor has no motor or brushes and is about half the size of the conventional units. It is adaptable to other speeds. There are four integrated circuits and two transistors used so it does not cost much to build. The basic unit is sold as a five level tape reader by JJ Glass for $7.95 each and the solid state devices are regularly advertised in *73*.

A "clock" oscillator operates in bursts of 45.5 cps rate, toggling a binary counter connected to a decoder which gives accurately timed pulses 22 milliseconds long, each one the length of one RTTY "bit." The sensing contacts in the reader are either closed or open depending on the punched holes on the tape, so, if the outputs of the decoder are connected to the sensing contacts, a serial output is obtained. Diodes are added to form an "AND" gate to prevent outputs from the decoder from shorting together. The serial output then is connected to a keying transistor which may be used to operate a keying relay or key direct.

When all five bits are formed, the sequence reaches pin 7 of the decoder. The positive going edge of the pulse trips a monostable multivibrator which resets the counter to zero, shuts off the oscillator, and turns on the tape advance transistor, advancing the tape one notch. When the monostable pulse ends, the output of the NOR gate immediately goes positive starting oscillation for seven more cycles. The adjustment of the pulse length of the monostable determines the length of time the stop pulse dwells at pin 10 of the decimal decoder. For 60 wpm, this would be 31 milliseconds. Later an easy method will be given to permit setting pulse widths without a scope. Note that the monostable pulse width and the actual stop pulse width differ slightly, so if you are checking pulses, the correct place to check is at the zero (pin 10) output of the decoder.

Gates have been wired to the stop-run switch so that the device will complete the character in the gate of the TD before stopping. Normally the external control jack is unused, a positive voltage of from 1.5 to 3.0 volts on this jack will start the TD.

The tape recorder has a large tape advance solenoid. Accordingly, it is pulsed with a high current for reliable operation. As mentioned above, the monostable pulse is actually about 20 milliseconds when the

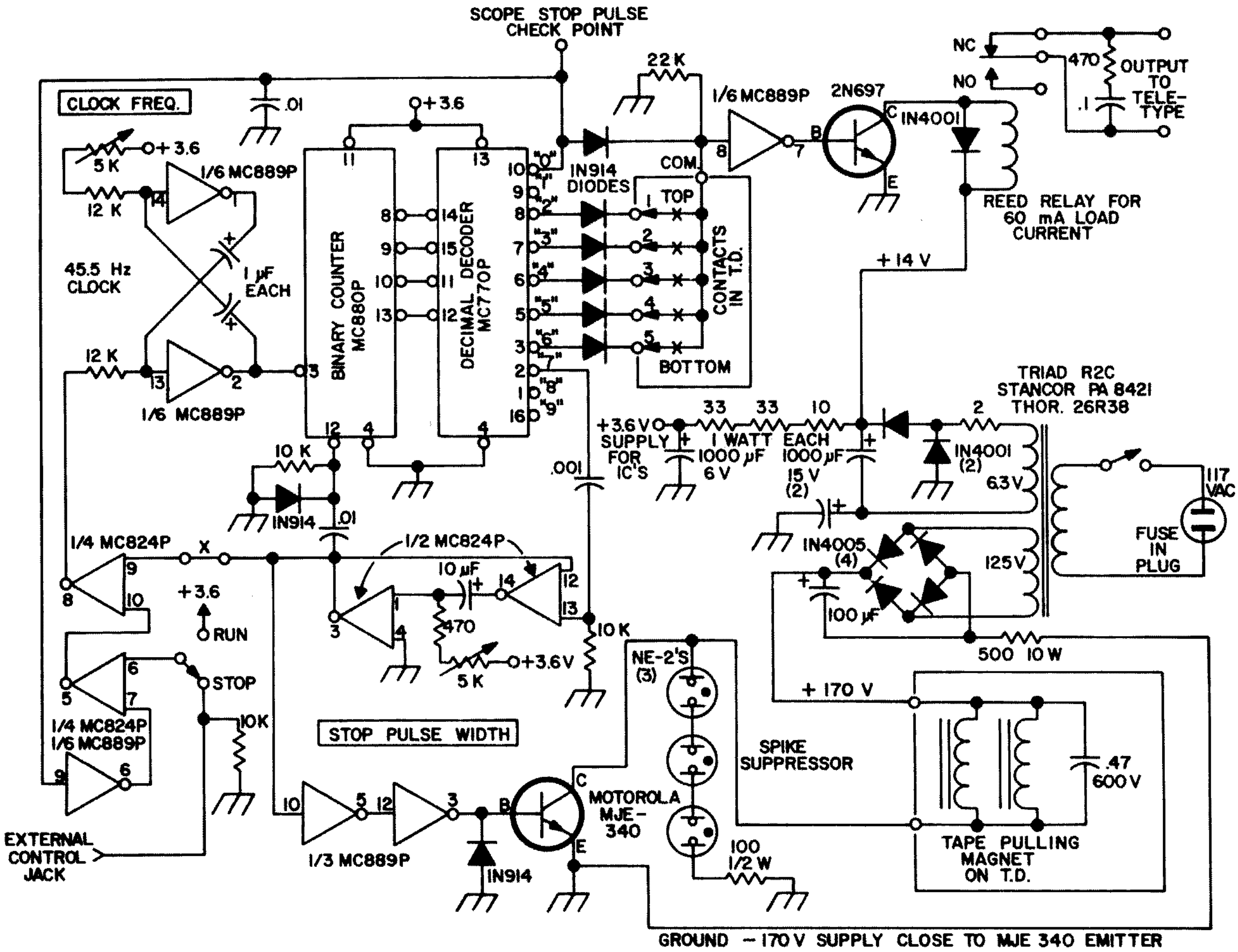


Fig. 1. Digital TD.

stop pulse is set at 31 milliseconds. The current through the magnet measures 200 mA peak but the duty cycle is so short that the average current is only about 25 mA. This permitted the use of a very small power transformer in the prototype, but other alternate members for substitutes are given. The solenoid advance transistor should not get hot in normal operation if you use the suggested types MJE 340 or HEP244. A MJE340 could also be used instead of the 2N697 for direct loop keying.

NE-2 spike suppressors have been used across the tape advance transistor to hold the transients down below the rating of the transistor. Other methods have been tried including the use of zener diodes and ordinary OB2 regulator tubes. The NE-2's do the job, are small, and cost 10¢ each. The tape advance solenoid would not operate at all when a silicon diode was connected across the coil as is usually done with relays to suppress transients.

A very simple power supply is used and was found adequate in the two models constructed. It would be advisable to check the power supply voltage to the IC's and adjust the value of the series resistors until it is approximately 3.6V. (Notes on the K4EEU TD, RTTY Journal, July-August 1972.)

When the tape recorder is received, it is necessary to strip off all the parts on the side near the Blue Ribbon connector with the exception of the pulling magnet detent. The large Advance solenoid and the linkage to the gate is removed and the gate is secured with a collar-setscrew so it cannot slide back and forth. The parts may then be mounted in the clear space. While it is possible to get all the electronics in the TD, it takes a little planning. You might want to mount the TD

on a small chassis and use this to mount the electronics, with the magnet supply in the head. An etched circuit board about 3" x 6" will hold all the integrated circuits and there is not too much wiring to do even if you want to hand wire the unit with small wire.

Two adjustments have to be made when the distributor is finished. The clock has to be set at 45.5 cps and the stop pulse width has to be adjusted. It should be pointed out that, due to the wide tolerances in electrolytic capacitors, it is possible that the clock will not adjust to 45.5 cps within the range of the pot. If this happens, merely change the value of the 12K resistor in series with the pot.

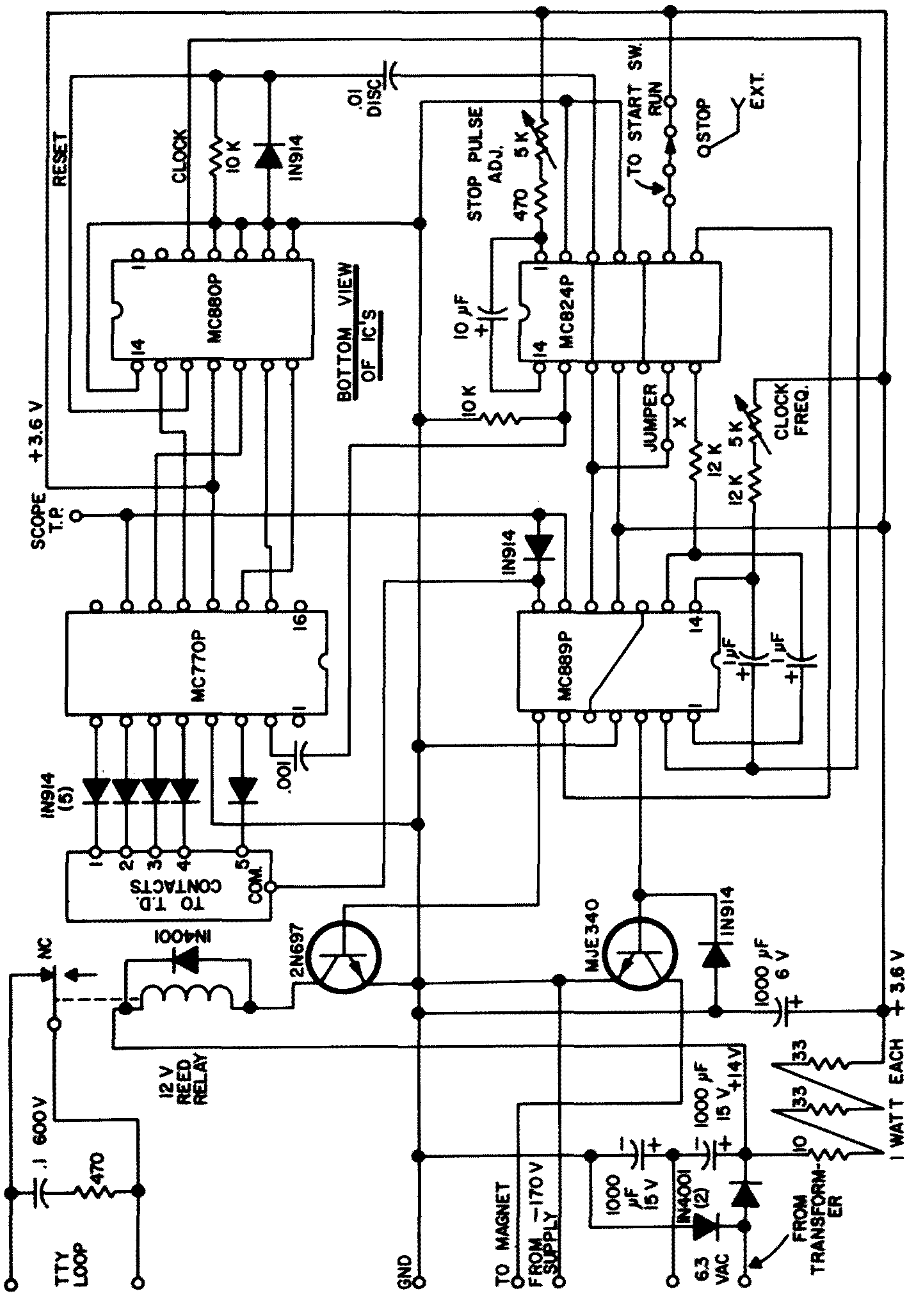
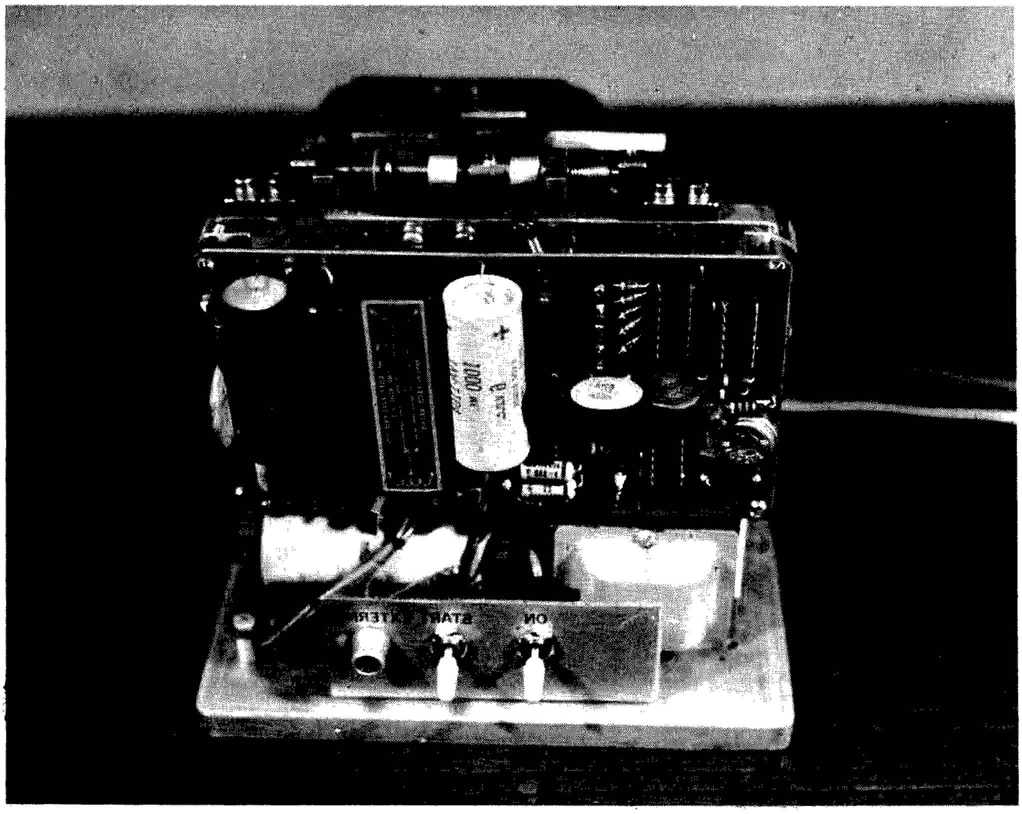


Fig. 2. Layout pattern of the Digital TD for printed circuit design.



First, open the control line to the MC824 gate at the point marked "X" on the schematic. Then run a tape and adjust the stop pulse width trimmer so that the solenoid has a snappy action and pulls tape satisfactorily, but don't worry about how it is printing. Now, adjust the clock so a measured 39" of tape goes through in one minute corresponding to 389 operations per minute. Restore the jumper at "X" and measure off 37" of tape and adjust the stop pulse width until this length runs through in one minute. The TD is now set at machine speed, 60 wpm. If the teletype printer is misprinting, check for a 22 millisecond pulse at each of the tape sensing fingers. If OK, check for good contact at the fingers – sometimes they need cleaning. The TD can be checked with an ordinary oscilloscope if this is necessary.

It should be recognized by the reader that as a solid state device, this unit might pick up rf from the transmitter and malfunction. The cure is shielding and bypassing external lines. Shielding was all that was necessary in the prototypes. W6FFC should be credited with the suggestion for measuring pulse widths and W4IGX made the pictures.

...K4EEU

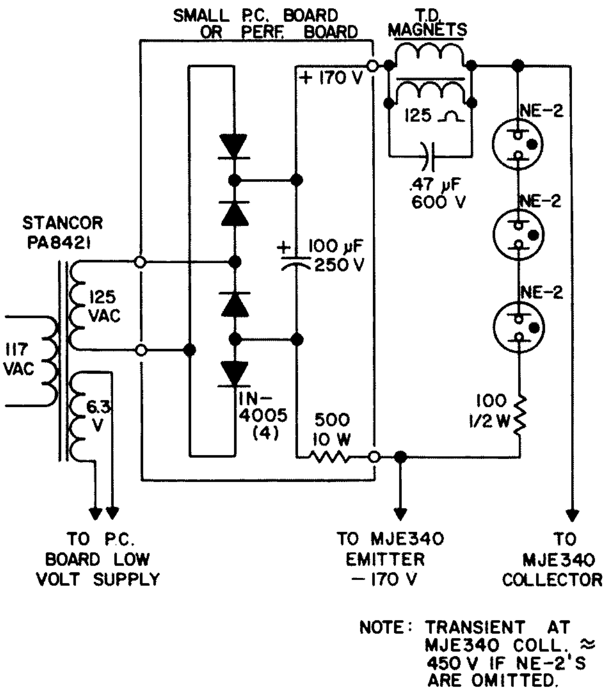


Fig. 3. Digital TD magnet supply board.

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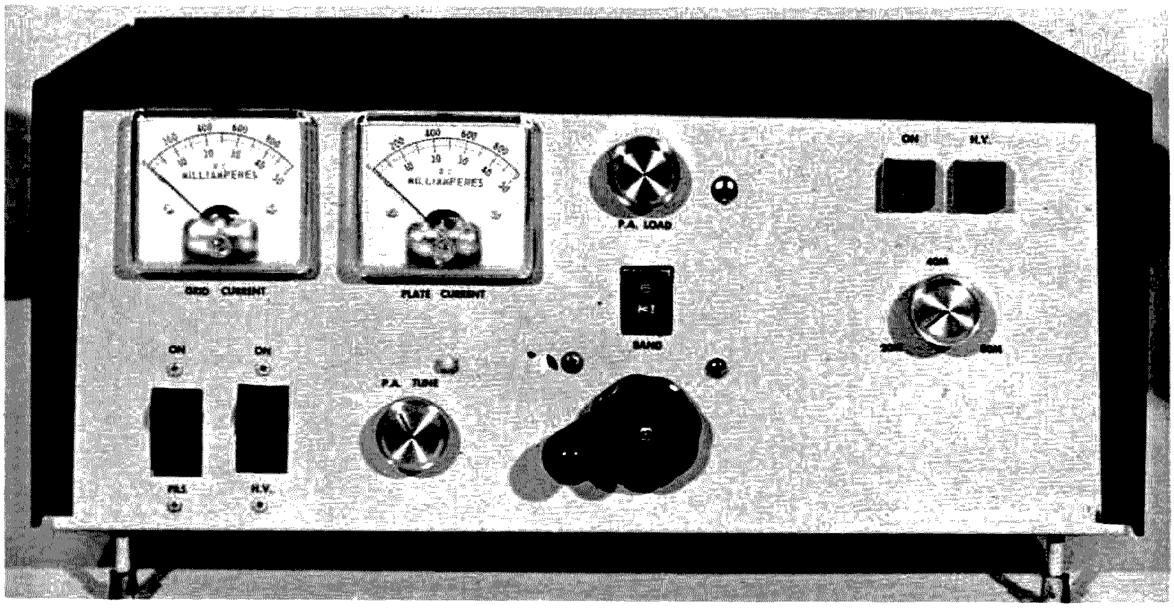
THE AMPLE AMPLIFIER

A Spunky Power Amplifier in a Compact Package for the Small Budget.

A few years ago I had the nagging urge to build another linear amplifier. I had been through the 811A phase and wanted something that would compare with commercial offerings. Still, I didn't want to stand the expense of special transformers, vacuum capacitors or bandswitching tank coils. My goal was a medium power amplifier that didn't look like it was built by the village blacksmith. It had to be simple. No space-consuming regulated screen supplies. And it had to be compact; compatible with a modern transceiver. It also had to be cheap. My XYL, like many, tolerates my hobby providing it doesn't cost anything.

The amplifier described below was conceived on a circuit found in Editors and Engineers, Ltd. Handbook. The original creation, designed by W6SAI, was presented as a versatile amplifier that could be built around 811's, 813's, 4CX250's, a 4-1000, or several other tubes, depending on the build-



This package produces over 1200W P.E.P. in a unique circuit featuring cathode driven 4CX250 B's. It is complete with power supply.

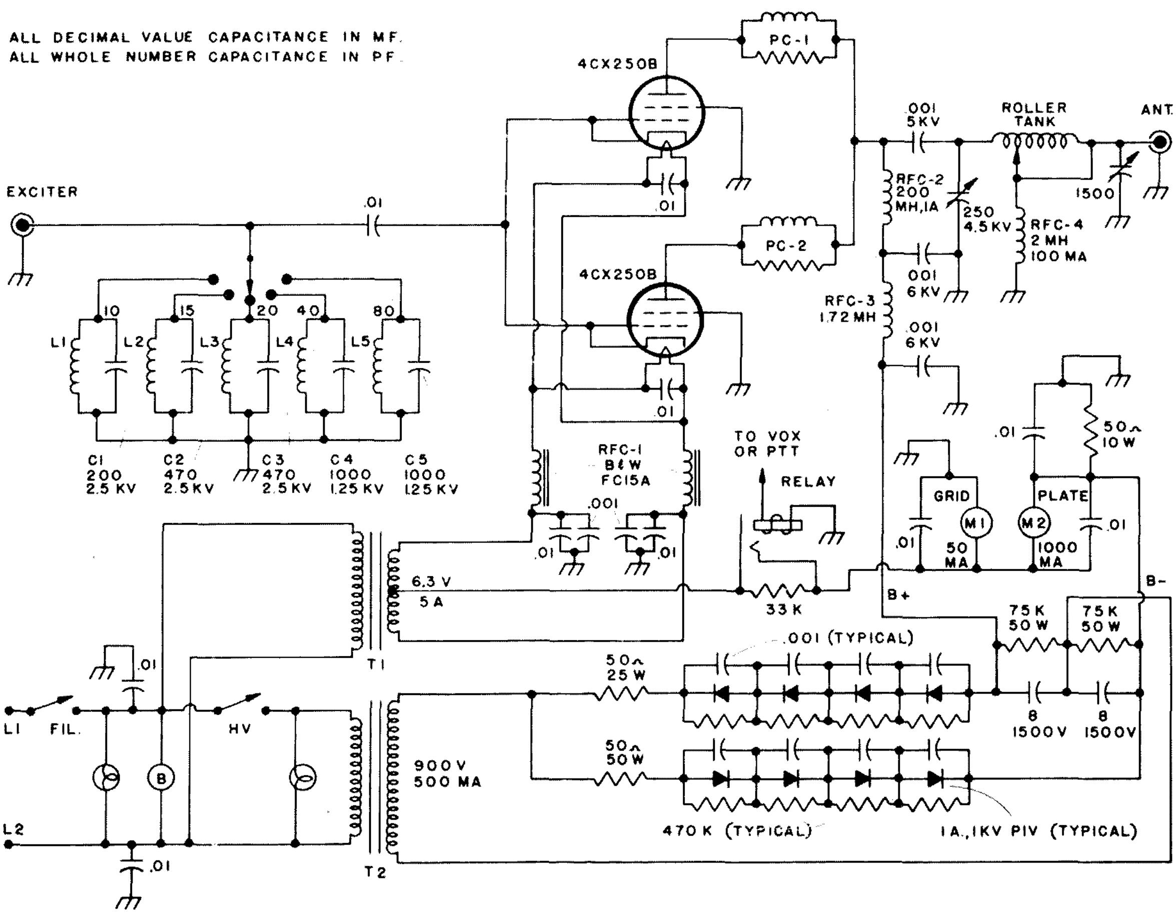


Fig. 1. L-1, L-2: (0.15 μH) 4 turns No. 16 enamel on National XR-50 ½ in. diameter. Slug removed from both coils. L3, L-4: (0.31 μH) 6 turns No. 14 enamel on National XR-50 form. Slug removed from L-3. L-5: 1.3 μH) 13 turns No. 18 enamel on National XR-50 form. PC-1, PC-2: 3 turns No. 16 enamel wound on 50 ohm, 2W carbon resistor.

er's preference. My choice of the 4CX250's was dictated by the fact that I wanted my amplifier compact. Also I had the bottles. The finished result has pleased me very much. It has proven to be very stable and free of parasitics. It has no "touchiness" characteristic of home brew projects. And it is not critical as to layout. My components are virtually shoe-horned in and yet there was no necessity to neutralize or relocate circuits. It has produced eyeball compliments and on-the-air results.

This is not being presented to the reader as an engineering triumph, however, but as a challenge to his imagination and enterprise. You may surprise yourself as I did!

The Circuit

The ceramic tetrodes are operated as low mμ triodes. The control grids are tied to the cathodes. With conventional Class-B grounded grid operation the grids would be promptly destroyed. In this mode, however, grid current is nil, idling current is low (about 35 ma), and feedthrough power is high. It takes about 150-200 watts of drive, but I consider this an asset, since there is no necessity to swamp the input. Either one of my transceivers drives it adequately.

A tuned-cathode input circuit is used to present a better load to the exciter. Rf isolation in the filament circuit is afforded by a home-brew filament choke. Bias is developed through a 33K cathode resistor. When in the standby mode, plate current is virtually zero. During operation a relay shunts out this resistor. When not driven the tubes will idle as stated above.

The tank circuit consists of a roller coil and tuning capacitor **from** a BC-375 tuning unit. A Barker **and Williamson** bandswitching inductor could be substituted, but I

happened to have the roller coil handy. The loading condenser could be aptly dubbed a free-loading capacitor. It came from a derelict broadcast set. A 500 pF mica capacitor in parallel with it provides plenty of capacity even for the 80 meter band.

The coupling capacitor, specified as .001 5 kv is solved by using parallel "beer barrels" from discarded television chassis. A parasitic suppressor is included in each plate lead, but no adjustment was necessary, and I found no tendency toward self-oscillation.

The power supply is solid state using the conventional doubler configuration. I hesitated about using only 4 μF of filtering. but it seems to do the job. By using electrolytics I think much more capacity could be engineered into the allotted space.

Construction

The amplifier is built on two aluminum chassis which are fastened to the cabinet with self-tapping screws. The rf section, measuring 4 x 6 x 2 inches, contains the tubes and associated wiring. The shield enclosure, built on aluminum angle, stands 4 inches over the chassis for a total "height" of 6 inches. Actually the rf assembly lays on its side and fastens to the back of the cabinet with a cork gasket as an air seal. A centrifugal blower delivers air through a hole in the cabinet into the bottom of the pressurized rf chassis.

The power supply is mounted on a 5 x 9 x 1½ inch chassis. Silicon rectifiers, surge resistors, and associated components fit easily underneath. The oil capacitors mount topside with the power transformer sitting directly behind them. Two angle brackets secure it to the rear of the cabinet. Electrical connection between the transformer and the power chassis is made through a husky four prong plug. With no room left for the bleeders, they are secured *outboard* on the supply chassis.

All other components; tuning capacitor, coil, loading condenser, filament transformer and relay are bolted or screwed directly to the steel cabinet.

The layout of components, as you can see, is non-critical, but it takes a little planning to come out with space for everything. Obviously there is no room for the blower inside. Except for a hand drill, a few files and two borrowed socket punches, the work was done mostly with sweat and tears.

Cooling

Entire articles have been written concerning the proper cooling of ceramic tubes. Needless to say, it is *not* sufficient to blow air *at* them. A modest investment will provide you with the chimney type sockets required to do the job. By pressurizing the bottom of the rf chassis and forcing the air to leave through the finned anodes of the tubes, you will find that correct cooling is accomplished. The builder is urged not to sample the temperature of external anode tubes because of the lethal voltage present! A high speed squirrel cage blower is strongly recommended. "Silent" blowers are more compact and less noisy, but I can assure you that they won't work well against back pressure (I tried it.) Hot air leaving the tubes flows into the cabinet, but since this particular cabinet is itself air tight, provision must be made to release th pent-up air. I punched a number of holes in the cabinet for this purpose (just behind the filament choke). Additional holes located in the cabinet bottom near the bleeder resistors serve to carry excess heat away from these components in the process.

Power Supply and Filaments

The power supply is built around a husky 900 volt transformer which was appropriated from an old projection television set. Silicon rectifiers in a voltage doubler develop 2,400 volts dc. The bleeders are mounted over a series of holes where air, exiting from the solid cabinet, carries the excess heat away. Besides offering a margin of safety and equalizing the voltage drop across the series filter capacitors, the bleeders provide some degree of voltage regulation.

4CX250's require 6.0 volts on the filaments. Excessive voltage will seriously impair tube life. You have the choice of inserting a series dropping resistor in the primary winding of the filament transformer or doing what I did. I patiently unwound and rewound the secondary winding of a 6.3 volt filament transformer. If you decide to do this, be sure to get the center tap electrically centered, or you will have a

transformer that overheats. It is really not as difficult as it sounds and certainly worth the try if you have an old filament transformer available. Naturally you must keep your plate and filament supply separate so that the tubes can be preheated prior to application of B+. A time delay relay can be employed for this purpose.

The filament choke in my rig is a home made affair wound on a ferrite rod ala Lafayette radio. A search through old magazines will provide the details. A commercial choke can be substituted if you throw old issues away!

Metering

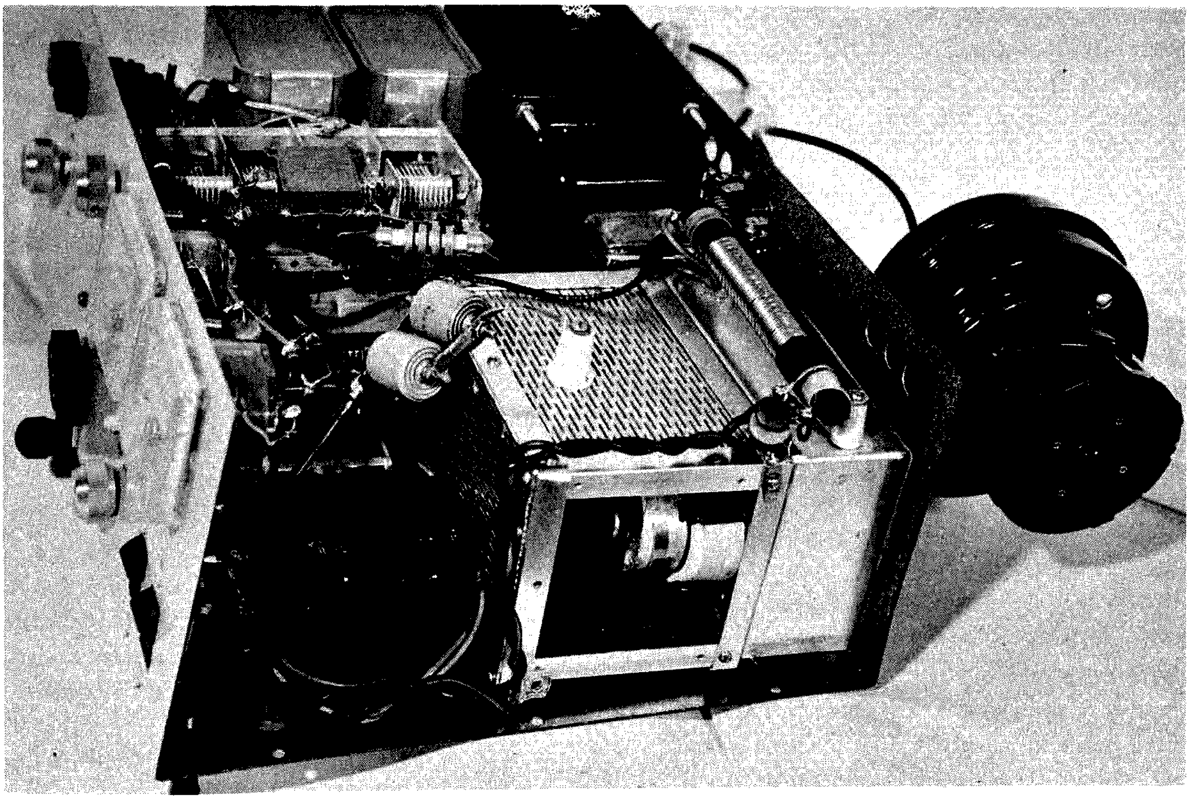
Plate current and grid current are monitored in the negative return leads as a safety precaution. This places B- above ground. a 50 ohm 10 watt resistor across the plate meter serves as a safety device should the meter coil open.

Tuned-Cathode Tank Circuit

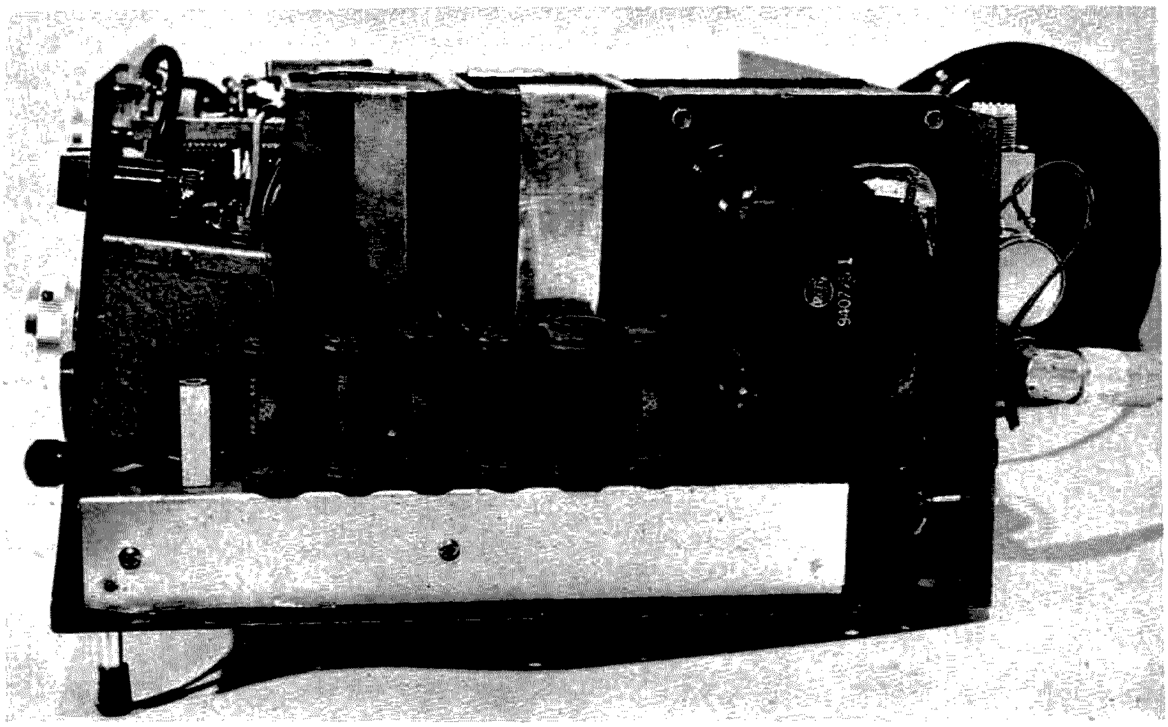
Separate tuned circuits are provided for each amateur band. My amplifier contains only the 80-40 and 20 combination. I built the linear to use with a 3 band transceiver which has since been replaced with an all band unit. I personally do not feel the need for higher power on the 10 and 15 meter bands, but coil values are provided for those who care. Coils are wound on slug tuned coil forms. The slugs are removed for 10-15 and 20 meters. A mica capacitor is soldered in parallel with each coil. Each coil and capacitor should be resonated, if possible with a grid-dip meter. After all coils are mounted around the bandswitch the box is shielded (a mini-box will do) and secured to the amplifier front panel.

Tuning and Operating

The amplifier should be carefully checked for any sign of instability before any attempt is made to drive it. This is done by connecting a dummy load and applying plate voltage, running the coil, tuning capacitor and loading capacitor through their range while monitoring grid and plate current. If you are as fortunate as I was, you will see zero grid current, and the plate meter will sit on 35 ma like a rock. If a weak parasitic is



This view shows the rf section and blower. The filament choke is mounted at the rear with the filament transformer at the front. The tuning capacitor is partially visible behind the transformer. The holes behind the filament choke release heated air from the cabinet.



The power and bleeder resistors occupy most of the right side of the amplifier. The small minibox is the tuned cathode assembly. The roller coil and loading condenser is sandwiched in the middle, not visible, the latter piggy-back on the coil. The husky power transformer is seen at the right.

found, it may help to compress the coils on the parasitic suppressors in the plate leads. If the amplifier is determined to be stable under all conditions it may be connected to the exciter. A realtive output meter in the output of the linear is a *must*. Tuning is accomplished much as with modern transceivers; ie: resonance should be found *quickly*. With a little practice all tuning and loading can be accomplished in a matter of several seconds. With the output meter in the line it is a simple matter to tune for *maximum output*. When properly tuned the grid current is very low; from plus two or three ma to minus one or two ma. Grid current should never be allowed to go beyond 10 milliamperes and the ideal condition is zero. This can be controlled with antenna loading and drive. Excessive antenna loading will produce negative grid current, excessive excitation creates high positive grid current. Under normal operating conditions grid current will flicker slightly (1-2 ma) with voice peaks. Plate current will peak approximately 1/3 to 1/2 of dc tune condition. Typically, plate current will talk up 100-150 ma depending on voice characteristics, etc. Shouting into the mike to produce higher readings will cause flat topping, distortion and citations. After a little experimentation the settings for tuning and loading capacitor and roller coil can be logged and will speed up the tuning process. Actually the amplifier is quite rugged and is easily operated with some experience.

It should be noted that the amplifier presents a different load to the exciter than does the antenna. This means that some retuning of the transceiver is required to go from *barefoot* to *shoes* operation. This is not inconvenient, however, and takes only seconds.

Conclusion

In closing, I would like to thank Editors and Engineers, Ltd. for allowing the use of this excellent circuit from the Radio Handbook. Though I've built many pieces of equipment in 15 years of hamming, this has certainly qualified as the finest of all my building experiences.

. . .K9PYY

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POPULAR SSTV CIRCUITS PART II

This is the second part of a two part article describing circuits and their functions in SSTV. Part I covered the use of operational amplifiers, timing and gating circuits, phase lock loops and sweep generation. This section will continue the discussion with descriptions of slow scan sweep drivers, subcarrier generators, limiters, discriminators and active filters. A regulated power supply that is suitable for the above circuitry is also presented.

Sweep Drivers

It was recognized very early in the development of slow scan television that magnetically deflected P7 radar tubes would produce brighter better focused pictures than were possible with electrostatic tubes. K9QYI and W9KVK rewound radar deflection yokes and used large tubes such as 6L6's and 6Y6's to deflect the beam. All of these attempts were successful but the difficulty of rewinding the yoke and the requirement of heavy dc power supplies kept electrostatically deflected monitors popular.

Today all of this complication has been changed with the introduction of complimentary transistors and economically priced operational amplifiers. A very fine sweep driver can be built that can drive ordinary TV yokes without modification. Surplus P7, 5FP7, and 7BP7 tubes can be driven by these sweep drivers. They produce excellent linear slow scan pictures. Consider the circuit shown in Fig. 2-34.

The initial sweep in this circuit is produced by charging capacitor C positively through size control R2 from a positive supply voltage. This RC time constant is made long compared to the pulse repetition period of the sync pulses applied to the base of transistor Q1. When the positive sync pulse turns on transistor Q1, the capacitor voltage falls to near zero voltage. IC1 is an operational amplifier with its non-inverting input connected to the capacitor positive going ramp. The output of the op-amp drives the complimentary pair transistors to produce an effective push-pull ramp at the emitter output. This emitter follower output is very low impedance and can drive TV yokes directly. In order to control gain and stability a negative feedback voltage is developed across a small resistor, R4, connected in series with the yoke. The overall gain is therefore set by the ratio of the 100K feedback resistor divided by the 33K input resistor.

As described in the discussion of the op-amp, offset or centering can be done easily by feeding current into the inverting input. The 741 op-amp is sometimes limited

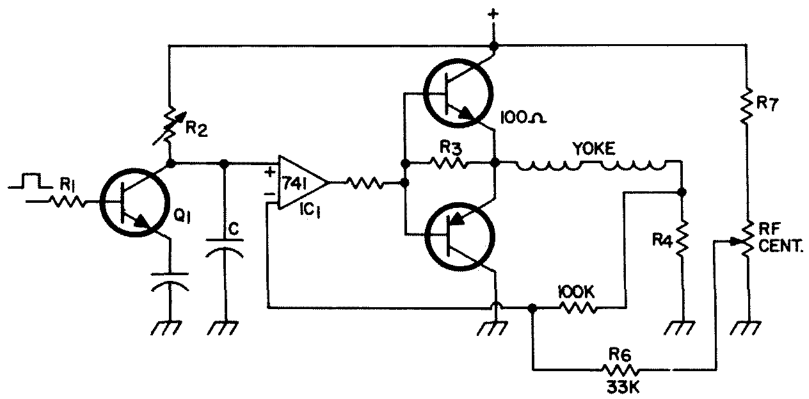

Fig. 2-34. Magnetic sweep driver.

in this application by having a slower slew rate than the compensated 709. The result of having this limitation is the appearance of a small demarcation line in the center of the slow scan picture at the time that the transistors switch across the base emitter potential. Some designers put a small resistor, R3, across the base emitter junction to smooth out the discontinuity by feeding op-amp current directly to the yoke. This works very well.

Subcarrier Generators

The most popular subcarrier generator is the voltage controlled multivibrator. Most SSTV systems use this type of subcarrier generator. The free running multivibrator is shown in Fig. 2-35.

The base of each transistor is connected to the opposite transistor collector by a C1 or C2 capacitor. Since the ac coupling does not permit either base to lock up into a stable state, the transistors oscillate back and forth at a rate determined by the coupling capacitors, base resistors and the voltage applied to the end of the base resistors. As an example, if Q1 goes from a non-conducting state to a conducting state, the base of Q2 is negatively driven because the capacitor CI cannot change its voltage instantly and, therefore, Q2 is turned off. CI now charges positively from approximately −10V toward the voltage level EB connected to the base resistor. The voltage builds up until the base of Q2 conducts causing opposite transistor Q1 to turn off by similar action The sketch of the voltage changes is shown in Fig. 2-36.

It can be seen that the larger the time constant T1, the longer the recycling time. It is also noticed that the potential toward which the capacitor charges determines the frequency because it changes the time when the charging curve crosses the base emitter conducting voltage. Higher EB voltage will drive the frequency higher. The multivibrator can be used as a voltage controlled oscillator. If EB is made to vary at an audio rate around some dc steady voltage, the VCO will have an FM output. Care should be taken to make sure that the potentials and RC time constants are adjusted properly so that the cycling takes place over a relatively linear region of the TC period otherwise the VCO output frequency will not vary linearly with input voltage. All voltages should be large relative to the base emitter voltage of

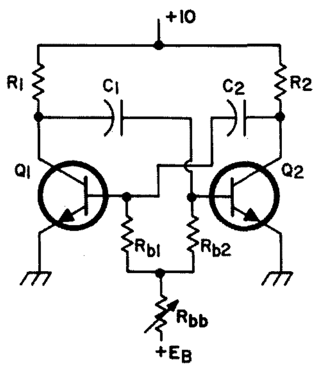

Fig. 2-35. Basic multivibrator.

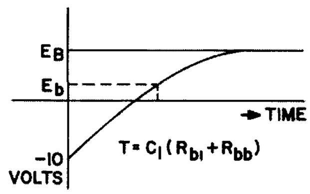

Fig. 2-36. Voltage changes in the basic multivibrator circuit.

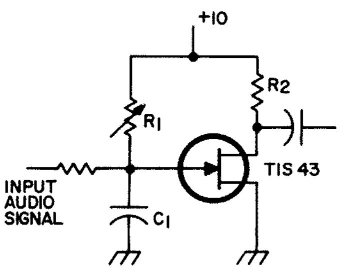

Fig. 2-37. Unijunction VCO oscillator.

the transistors. Some experimenters have used constant current sources instead of base resistors to give linear charging of the capacitors. This results in a very linear VCO.

Another popular type of VCO is the unijunction oscillator. The basic oscillator is shown in Fig. 2-37.

The VCO utilizes the negative resistance of the unijunction transistor to cause the capacitor C1 to charge and discharge at a rate determined by the product of R1 and C1. When capacitor C1 charges to a given level, the unijunction transistor conducts and discharges the capacitor C1. If audio is applied to the capacitor C1, the net charge can be changed at an audio rate and, therefore, cause the unijunction transistor to vary in its output frequency. In this way an FM SSTV signal is formed. The resistor R2 is for temperature compensation. Usually the unijunction oscillator is designed to operate at twice the desired frequency in order to drive a JK flip-flop to give a square wave output for better filtering. The output voltage of the unijunction oscillator is a very narrow pulse.

Last and the best is the phase lock loop VCO. We have used the Signetics 565 in several applications. It is extremely versatile and permits a variety of signal processing functions. The SE 565 is an integrated circuit consisting of a VCO phase detector and filter. The VCO can be used directly by adding the correct capacitor on the VCO terminals. The hookup and calculated values are shown in Fig. 2-38. The new Signetics SE/NE-566 IC VCO may also be used.

The linearity is extremely good and is the best choice for the slow scan experimenter since the other functions of the PLL can be utilized in a clever manner to produce a very sophisticated slow scan FM generator.

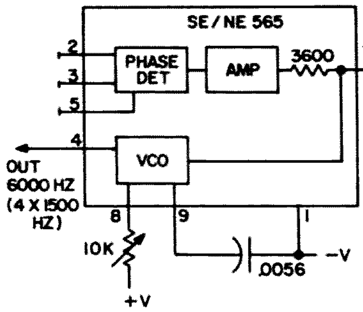

Fig. 2-38. Phase lock loop VCO.

Limiters

Slow scanners in the past have used several kinds of limiters preceding their discriminators. In the early tube Macdonald monitor, the limiting action was through the use of grid resistors in the conducting grid audio amplifiers. Today the standard limiter utilizes the operational amplifier. The 709 is the best economical choice since it can be compensated for higher frequency response and has a higher slew rate than the internally-compensated 741.

The non-saturating operational amplifier is shown in Fig. 2-39. The limiting action comes from the back-to-back diodes across the input and output terminals. The input diodes across the inverting and non-inverting inputs are protective diodes. The non-linear feedback from the feedback diodes result in a logarithmic relationship between the input voltage and the output. The output voltage is approximately the drop of the diodes. If greater output is needed, the output can be subdivided to supply the two feedback diodes.

It is also possible to utilize a saturating limiter (Fig. 2-40). Again an operational amplifier is used in another configuration. This time the amplifier output is driven to the supply voltage limits. If the supply voltage has a ripple, there is danger that the output will also show these ripples. The gain is very high and care must be taken to make sure that the output is square wave.

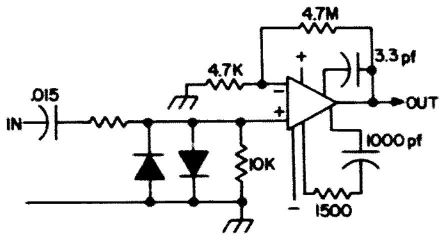

Fig. 2-40. Saturating op-amp limiter.

The slew rate and frequency response of the high gain op-amps make both of these limiters poor at frequencies higher than audio frequencies. At slow scan frequencies they both perform reasonably well. Again diodes are used to protect the input of the op-amp.

Discriminators

Slow scan television uses an FM subcarrier to give noise immunity on high frequency (HF) radio channels. The three important standard frequencies are:

1. 1200 Hz – sync
2. 1500 Hz – black
3. 2300 Hz - white

In order to utilize the transmitted slow scan information, it is necessary to FM detect the transmitted signal to produce an amplitude modulated signal to synchronize the sweep circuits and to intensity modulate the Z axis of the monitor picture tube.

The earliest slope detector described in the literature of March, 1964 *QST* was the one-sided slope detector with a separate resonant 1200 Hz tuned circuit for sync recovery. The success of this monitor speaks well for the circuit. The frequency versus amplitude response curve was approximately linear. Figure 2-41 shows the response of

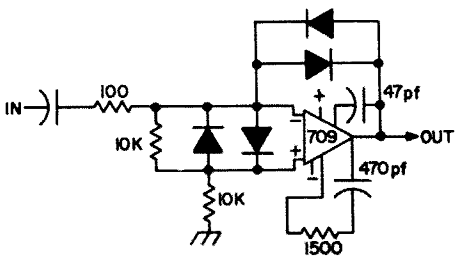

Fig. 2-39. Non-saturating op-amp limiter.

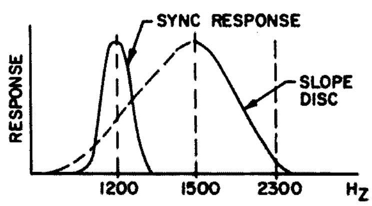

Fig. 2-41. Negative slope discriminator.

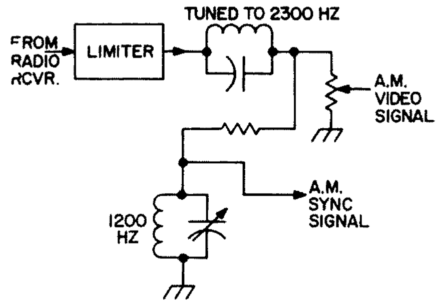

Fig. 2-42. One-sided negative slope discriminator and sync receovery circuit.

both the sync recovery circuit and of the slope discriminator. The block diagram of the circuit is shown in Fig. 2-42.

It is interesting to note that in the absence of signal that the response approaches 2300 Hz and the Z axis modulation is maximum beam illumination. This causes noise pulses to appear as white streaks on the viewed image.

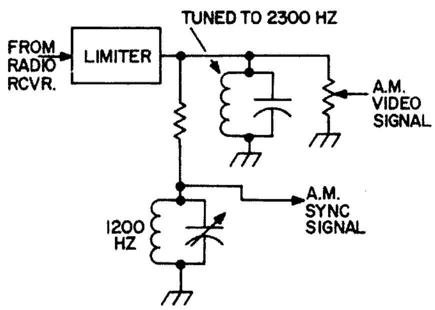

Fig. 2-43. One-sided positive slope discriminator.

This effect has been corrected by some builders by tuning the slope discriminator to have a positive slope instead of a negative slope. The immediate effect of doing this is to reverse the video from black to white and vice versa. This can be corrected by adding a stage of video phase reversal. This is extremely easy to do if operational integrated circuit amplifiers are used. The response of the positive slope discriminator is shown in Fig. 2-43. The block diagram is shown in

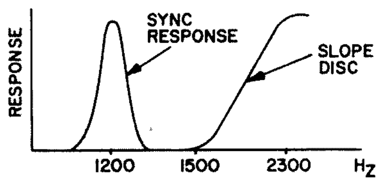

Fig. 2-44. Positive slope discriminator.

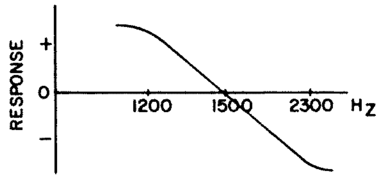

Fig. 2-45. Double-sided discriminator.

Fig. 2-44. In the positive slope discriminator noise pulses have a tendency to drive the response to 1500 Hz or black output to the monitor screen.

A better solution to video recovery is the use of two tuned circuits to create a double sided discriminator linear response curve. This response can extend to the 1200 Hz sync frequency or just include the video spectrum. The entire spectrum is covered by the two sided response curve shown in Fig. 2-45. The block diagram is shown in Fig. 2-46. This characteristic can be created by the use of two tuned circuits tuned to 1200 Hz and 2300 Hz respectively. The method of sync extraction used in such circuits can be either (1) another narrow band tuned circuit or active band pass filter tuned to 1200 Hz, or (2) use of a phase lock loop or integrator to filter the sync pulses recovered from the discriminator response.

It should also be mentioned that there are new integrated circuit phase lock loop circuits such as the Signetics 565 on the market which seem to offer some possibility of direct detection of the FM signal. The bandwidth of these circuits is marginal at the subcarrier frequency however.

Another type of discriminator called the pulse counting discriminator can be used to detect the FM signal and requires no tuned circuits of any kind. This circuit works on the principle that a monostable multivibra-

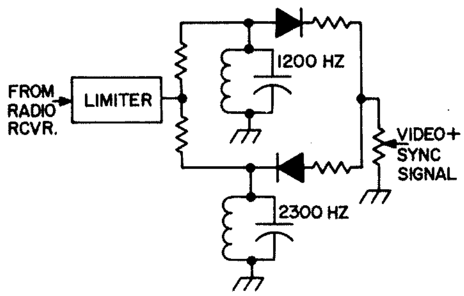

Fig. 2-46. Double-sided discriminator circuit.

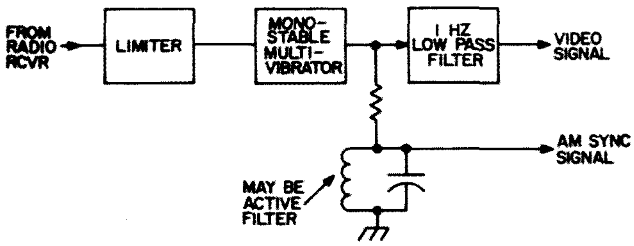

Fig. 2-47. Pulse counting discriminator.

tor can be triggered by the zero crossings of the amplitude limited FM signal. This monostable oscillator has a recovery time of less than one half of the period of the highest frequency detected. The net result is a series of equal width pulses occurring at every zero crossing of the FM signal. The output voltage of this monostable oscillator has an average value equal to the desired vido slow scan signal. In order to recover only this low frequency signal, it is necessary to filter the square wave output of the multivibrator by means of a high order active band pass filter. The block diagram is shown in Fig. 2-47.

In order to ease the requirements of the filter, the monostable oscillator is connected to produce square waves of twice the incoming FM signals that vary between 1500 and 2300 Hz and are in reality 3000 and 4600 Hz in the output of the monostable. Since the slow scan video only extends to 900 Hz, filtering is made relatively easy.

Again as in other types of discriminators, the sync pulses at 1200 Hz can be recovered in any number of ways. An active bandpass filter centered at 1200 Hz with manual tuning of the center frequency seems attractive and utilizes similar circuitry as used in the multiple pole active low pass filter used on the pulse counting discriminator.

Active Filters for Slow Scan TV

Anyone who is engaged in the construction of slow scan TV gear soon learns that filters play an important part in the performance of the equipment. In the early years of slow scan TV, passive filters were almost exclusively used by slow scanners since they were able to capitalize on the filter design experiences of RTTY hams. The availability of 88 mH and 44 mH chokes made it possible to use the RTTY designs with slight modifications.

The design of practical filters is difficult and the filters are not very rewarding in performance because of passive loading effects. Today with active filter design made possible by the use of low-priced operational amplifiers, anyone can be a filter designer and achieve excellent results. The biggest problem is knowing where to start.

Active filter design is made easy and excellent performance is achieved because the elements are isolated by op-amps. These op-amps have extremely high input impedance and nearly zero output impedance when hooked up in the voltage follower configuration. Before discussing the actual design of filters, let's examine the filter performance specification needed in a slow scan monitor to recover the sync pulses and video information.

The sync frequency is a burst of 1200 Hz which lasts for 5 ms and 30 ms respectively for the horizontal and vertical synchronization. The length of the pulse gives the designer the required bandwidth of the filter needed to separate the pulses from the FM video information which lies between 1500 Hz and 2300 Hz. A good approximation of the bandwidth needed for a 1200 Hz – 5 ms burst is shown in Fig. 2-48.

τ is 5 ms or 0.005 seconds. If it is desired to pass the major part of this pulse spectrum, the filter BW should equal $2/\tau$ = 2/0.005 = 400 Hz. This means that the energy of the major frequency lobe of the pulse will be passed by the filter. The other minor lobes will be rejected. If the filter is made wider, video signals will get through the filter and if the filter is made narrower the rise time of the pulse will be increased.

Let us now design an active bandpass for sync recovery filter. This will be a low pass filter centered around 1200 Hz. It will have a bandwidth of 400 Hz. It will use no coils and will provide for adjustment of the center frequency for SSB carrier reinsertion error.

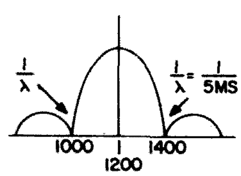

Fig. 2-48. Bandwidth of horizontal sync pulses.

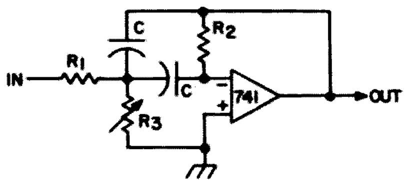

Fig. 2-49. Active bandpass filter.

The configuration that will be used is shown in Fig. 2-49. It is called a multiplier feedback active bandpass filter. We can now choose arbitrarily the gain and the value of the capacitors since resistors are cheaper than capacitors, and can be purchased in wider selected sizes.

A = Gain = 10
C = 0.01 microfarads
B = Bandwidth = 400 Hz
F = Center frequency = 1200 Hz

$$R_1 = \frac{1}{2\pi BAC} = \frac{1}{6.28 \times 400 \times 10 \times 0.01 \times 10^{-6}} = 3980\Omega$$

$$R_2 = \frac{1}{\pi BC} = \frac{1}{3.14 \times 400 \times 0.01 \times 10^{-6}} = 79{,}600\Omega$$

$$R_3 = \frac{1}{2\pi C\left(\frac{2F^2}{B} - BA\right)} = \frac{1}{6.28 \times 0.01 \times 10^{-6}\left(\frac{2 \times 1200^2}{400}\right) - 400 \times 10} = 5000\Omega$$

The complete filter is shown in Fig. 2-50. R3 can be made adjustable to allow for a slightly different center frequency. In many ways this is an easier route than using a parallel tuned 88 mH inductance for sync recovery.

Now let's design a vertical pulse filter. The bandwidth needed is again twice the inverse of the pulse width time.

Bandwidth $B = 2\left(\frac{1}{\tau}\right) = \frac{2}{30\text{ ms}} = \frac{200}{0.03} = 66.6$ Hz. The values and parameters are:

C = 0.06 μF
A = 10
B = 66.6 Hz
F = 1200 Hz

$$R_1 = \frac{10^6}{6.28 \times 66 \times 10 \times .06} = \frac{10^6}{251} = 3980\Omega$$

$$R_2 = \frac{10^6}{3.14 \times 66.6 \times .06 \times 10^{-6}} = \frac{10^6}{12.53} = 79600\Omega$$

$$R_3 = \frac{10^6}{6.28 \times .05\left(2\left[\frac{1200 \times 1200}{66.6}\right] - 66.6 \times 10\right)} = \frac{10^6}{.314(43200 - 666)}$$

$$= \frac{10^6}{.314(41{,}534)} = \frac{10^6}{13{,}300} = 750\Omega$$

The circuit for vertical sync is shown in Fig. 2-51.

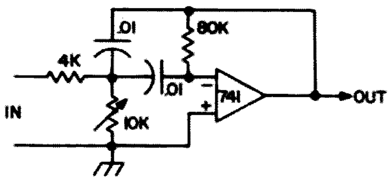

Fig. 2-50. Active BP filter for 1200 Hz.

Most slow scan monitors rectify the 1200 Hz sync burst in order to recover the video sync pulse. It is better to use full wave rectification because the carrier (1200 Hz) is converted to 2400 Hz and consequently it is easier to filter the desired separated pulse. As before the bandwidth of the sync pulse (video pulse) is related to $1/\tau$. In this case

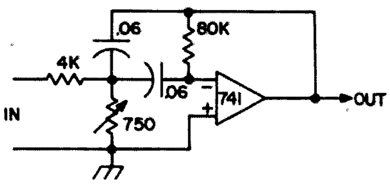

Fig. 2-51. Vertical sync recovery circuit.

there is a frequency fold over at zero frequency because negative frequencies do not exist in real time. The bandwidth needed to recover the pulse is $1/\tau = 1/5\text{ms} = 200$ Hz for the horizontal pulse and $1/300\text{ms} = 33$ Hz for the vertical pulse.

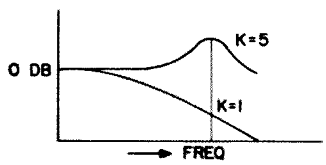

Fig. 2-52. Low pass filter response.

This filtering job is relatively easy since the frequencies to be separated are many octaves apart (i.e., 200→2400 Hz is 200 - 400 - 800 - 1600 - 3200 or about 3½ octaves apart. A three section low pass filter will provide about 20 dB or a 10/1 reduction of the 2400 cycle component. More sections

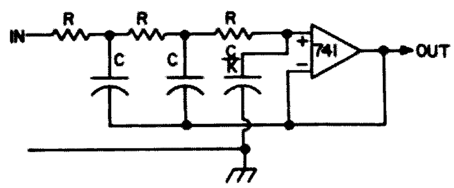

Fig. 2-53. Low pass sync pulse filter.

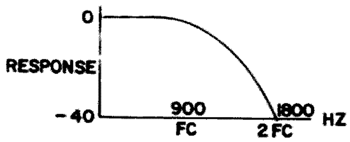

Fig. 2-54. Seventh order Butterworth filter response.

can be added if more rejection is needed. The circuit shown is interesting in that it has provision for providing a rising response near cutoff on the bandwidth edge as shown in Fig. 2-52.

This rising response can act to decrease the rise time of the pulse, but if it is used to extreme, it can cause ringing of the recovered pulse. The circuit is shown in Fig. 2-53 which provides about 18 dB/octave attenuation after cutoff.

LET R = 100 K
BW = 200
$R = 1/\omega c$ or $C = 1/2\pi fR = 1/6.28 \times 200 \times 10^5 = 0.0079$
$= 800$ pF

K probably should be chosen by experiment to give best rise time without ringing. The component values for both vertical and horizontal sync pulse recovery is as follows:

HORIZONTAL	VERTICAL
R = 100K	R = 100K
C = 0.008 μF	C = 0.048 μF
$\frac{C}{K}$ = 0.0016 μF	$\frac{C}{K}$ = 0.009 μF

There is one additional filter that is needed in a slow scan monitor that must be designed very well. The SS video information is about 900 Hz wide. This must be recovered from the FM subcarrier which varies from 1500 – 2300 Hz. Full wave AM detection is done after FM detection and results in frequency doubling of the spectrum. This means that the unchanged 0 – 900 Hz slow scan video signal for display must be separated from the 2400 Hz sync and 3000 Hz black signal. These two signals are less than two octaves apart from the 900 Hz video so a fairly sophisticated filter must be used.

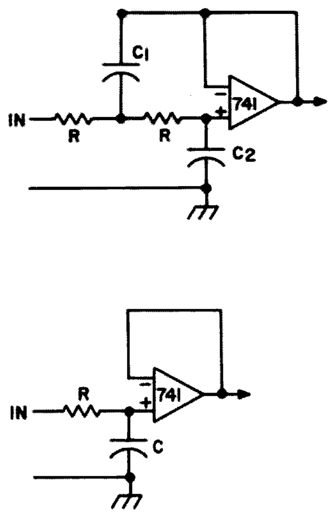

Fig. 2-55. Second order Butterworth (full sections)

For our purposes a Butterworth design will be chosen which has a flat passband response. Other designs permit a variation in the passband response in order to achieve greater rejection of the frequencies near cutoff or a better phase response.

We would like to reject the carrier components, at least 40 dB between 1 kHz and 3 kHz. Figure 2-54 shows the response of a seventh order filter. This Butterworth filter attenuates about 40 dB/octave so this design can be used.

The configuration for each section (3 and ½ sections needed) is shown in Fig. 2-55.

For convenience design constants are shown for orders of Butterworth filters up to 7th.

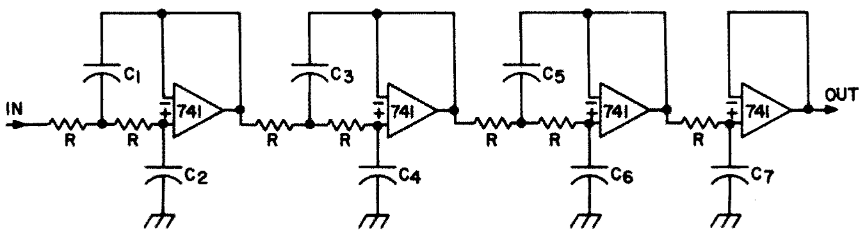

Fig. 2-56. Seven pole Butterworth low pass filter.

Order	K1	K2	K3	K4	K5	K6	K7
1	1						
2	1.414	.707					
3	2.0	.5	1				
4	2.61	.38	1.08	.924			
5	3.24	.31	1.24	.81	1		
6	3.86	.26	1.42	.707	1.04	.97	
7	4.50	.223	1.604	.624	1.11	.9001	1.0

The design of the filter is as follows:
Let all R's = 100K
Let BW = 1000 Hz
So $W_c = 2\pi F = 6.28 \times 1000 = 6280$
$R\,W_c = 6280 \times 10^5$
$RW_c = 628 \times 10^6$

	Calculated Value pF	Standard Value μF
$C1 = \frac{K1}{RWc} = \frac{4.49}{628 \times 10^6} =$	7150	0.0068
$C2 = \frac{K2}{RWc} = \frac{.223}{628 \times 10^6} =$	355	0.000360
$C3 = \frac{K3}{RWc} = \frac{1.6}{628 \times 10^6} =$	2550	0.0025
$C4 = \frac{K4}{RWc} = \frac{.624}{628 \times 10^6} =$	992	0.01
$C5 = \frac{K5}{RWc} = \frac{1.11}{628 \times 10^6} =$	1770	0.02
$C6 = \frac{K6}{BWc} = \frac{.901}{628 \times 10^6} =$	1430	0.0015
$C7 = \frac{Wc}{BWc} = \frac{1}{628 \times 10^0} =$	1590	0.0015

Although it will probably not be needed in the slow scan TV design, this procedure can easily be used to build high pass filters. In this case, choose the C's equal and calculate the R's with this formula: $R_1 = 1K_1W_cC$ etc. R's and C's exchange position s in all the circuits for a high pass configuration.

The complete filter design is shown in Fig. 2-56.

Power Supplies

Many slow scanners can still remember the days when the design and construction of a power supply was the simplest part of building a piece of electronic equipment. With the introduction of solid state devices and their requirements for low voltage and high current came the need for complicated regulated power supplies.

The various parts of a solid state device will interact through the common resistance of the power supply if the power supply output impedance is not low. This effect can be easily understood by studying the simplified power supply circuit shown in Fig. 2-57.

In this diagram the dc source is assumed to have zero impedance. The normal power supply resistance has been added together and called R_S. The voltage of this dc source is the output voltage of the power supply in the absence of any load.

Upon the application of load, the output voltage drops to a lower value. This new output voltage is given by:

$R_{out} = E_{OC}\ [R_L/R_L+R_S]$

where E_{OC}=dc source voltage (open circuit).

This drop in voltage is called voltage regulation. This equation easily shows that the only way the output voltage can be made to remain constant with load is to reduce RS to zero ohms. Normally several loads are connected to a power supply simultaneously and each separate load causes the voltage to vary. This results in coupling between circuits and usually means that solid state devices refuse to operate in the desired manner. It has been stated that it is output resistance that must be near zero ohms but in reality it is the impedance that becomes important. Loads vary in their load requirements over many frequencies so care must be taken to assure that the power supply has good regulation throughout the frequency range of the load requirements.

In order to reduce the internal impedance to near zero value, feedback is used to force the input voltage up when the output voltage tries to drop. In addition some kind of a reference voltage is used to provide the standard of regulation desired. In order to build a regulated power supply, it is necessary to drop voltage across a series regulator. This series regulator is provided with a feedback voltage from the output circuit to

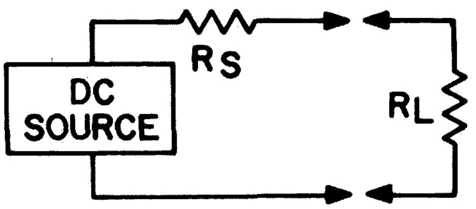

Fig. 2-57. Simplified unregulated power supply.

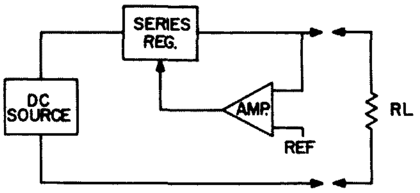

Fig. 2-58. Simplified regulated power supply.

cause the regulator to either drop or pass just the amount of voltage to compensate for the output change. This is demonstrated in the circuit shown in Fig. 2-58.

The amplifier compares the input voltage from the power supply output circuit with the reference voltage. If the output voltage is higher than the reference voltage then the series regulator is turned off to drop more voltage. If it is lower, the opposite happens. In all cases it is necessary to have the dc voltage about 50% higher than the desired output voltage in order to make the series regulator operate effectively.

This amplifier can be an operational amplifier. From the previous description of its operation, it will be remembered that it has both inverting and non-inverting inputs. These inputs can be used to advantage. Usually the reference is a zener diode that has a constant voltage drop of about six volts. This diode should be temperature stable and operate with as low dissipation as possible. Regulated power supplies should have some kind of current limiting. Most hams sooner or later short a regulated power supply and since the power supply is incapable of providing infinite current, it burns out the series regulator. One favorite way to prevent this is to put a small resistor in series with the regulator inside the feedback loop. The IR voltage developed across this resistor is used to turn off the regulator

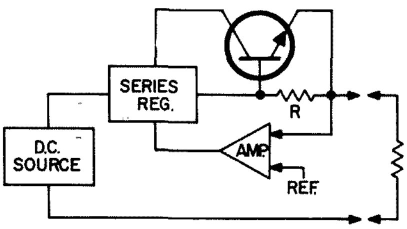

Fig. 2-59. Current limited regulated power supply.

automatically. The resistor size is usually chosen so that the maximum current times the resistance value equals the base emitter drop of a silicon transistor (0.6V). This is shown in Fig. 2-59.

Integrated circuits today require quite a large number of dc voltages. As an example, linear devices such as operational amplifiers frequently use both positive and negative regulated voltages. The desired voltage ranges of these devices is from 0 to ±15V. In contrast digital circuits require much lower voltages for their logic levels, but have much higher current requirements than that of the linear integrated circuits.

It was with this thought in mind that the power supply circuit described in this section was designed. Its output voltage is 0 to ±15V at 200 mA for operational amplifiers and 0 to +5 at 2 amperes for digital gate circuits. Usually the amplifier designer needs equal positive and negative voltages. This design provides equal positive and negative voltage that track each other with one manual control. Current limiting is provided for both positive and negative outputs.

The low voltage digital voltage is adjustable to +3.8V for RTL logic and +5V for TTL logic. No current limiting is provided.

The complete schematic is shown in Fig. 2-60. The transformer and rectifiers must be chosen to meet the current and voltage requirements of the load. A 35V center tapped, 3 ampere transformer is adequate. The four rectifiers are connected to have outputs of positive and negative 20V and each full wave rectified voltage is heavily filtered by a large capacitor.

The reference voltage used in the design is a 1N5233 zener diode that is turned on by the positive unregulated 20V through a 1000Ω resistor. Considering just the 12V positive supply for the moment, it is noted that the series regulator consists of two transistors hooked in a Darlington pair connection to increase the effective beta. This assures that the limited output current of the operational amplifier can effectively control the output current.

The 741 op-amp compares the subdivided zener reference voltage to the subdivided output voltage and therefore forces the series regulator to make them equal. Current

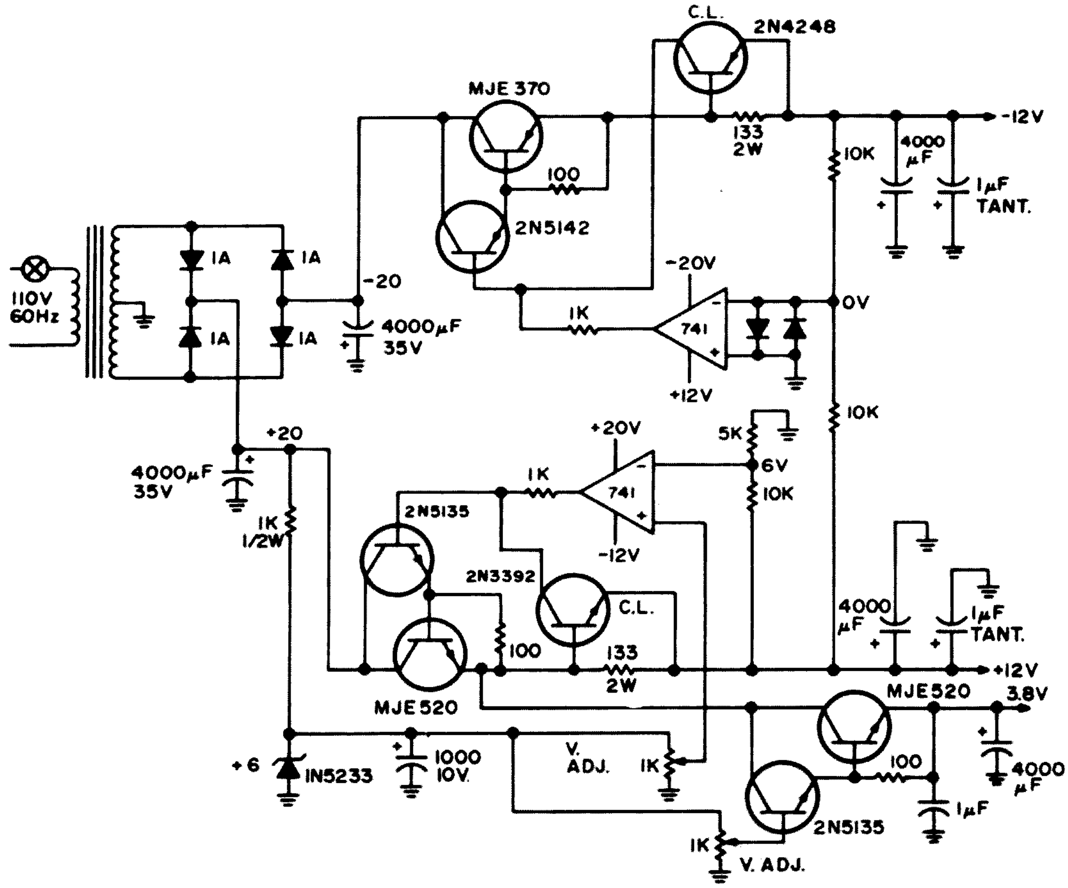

Fig. 2-60. Regulated power supply.

limiting is provided by developing a voltage across the 0.33Ω resistor and therefore causing the 2N3392 transistor to load down the op-amp. This causes the series regulator to partly turn off and limits the regulation. Under this condition, the series regulator is dropping the entire voltage at the maximum regulator current. Its dissipation capability must be adequate.

The negative supply operates in much the same way as the positive supply. The major difference is the use of PNP transistors. Current limiting is also provided here. The reference in the negative supply comes from an input from the positive supply. Instead of a zener reference diode being used, the two inputs to the op-amp are operated at near ground potential. One input is directly grounded. The other input receives its voltage from the center connection of two equal resistors which are connected to the positive and negative outputs. When the negative and positive power supplies have equal voltages, the input or center connection of the resistors is at ground potential. This is the necessary condition for balance. When the positive voltage is adjusted by the control, the negative voltage tracks it perfectly.

In all cases output filter capacitors are added to the output terminals to assure that the high frequency output impedance is low. One of these capacitors should be tantalum in order to give low high frequency impedance.

The logic supply is similar to the other positive supply. Again a Darlington pair is used to give the necessary beta control. The control reference is a pot, connected across the reference zener diode. The series regulator receives its voltage from the regulated positive 12V before the current limiting resistor. The MJE 250 in the higher positive voltage supply must be capable of supplying the current for both positive voltage circuits.

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THE CAN SCANNER

No camera? Get started on Slow Scan with a unit that produces high quality pictures from transparencies.

The can scanner may appeal to those of you who have just got a slow scan monitor operating and now need a quick, inexpensive method to make some pictures of your own to transmit. Further, the system may be expanded later into a plumbicon camera with only a coffee can to discard.

The can scanner idea appears as old as slow scan itself. Although I first heard of it from Bill W7ABW, when I told others later that I used a can scanner I found most of them had also started out with a can scanner.

The heart of the can scanner is the slow scan generator and dc amplifier of Ralph Taggart WB8DQT, described on page 89 of July, 1972 *73 Magazine* The reader is advised to read his article in addition to this one. The construction and alignment of the generator and dc amplifier is covered in full detail in that article, so they will not be repeated here.

A two-pound coffee can (with a 931 photomultipler tube and its associated 1 MΩ resistors mounted on the socket) in conjunction with your existing monitor, make up the scanner.

Notice, also, the can scanner may be used with either electrostatically or electromagnetically deflected monitors.

How It Works

A block diagram of the complete system appears in Fig. 1. The audio output of the

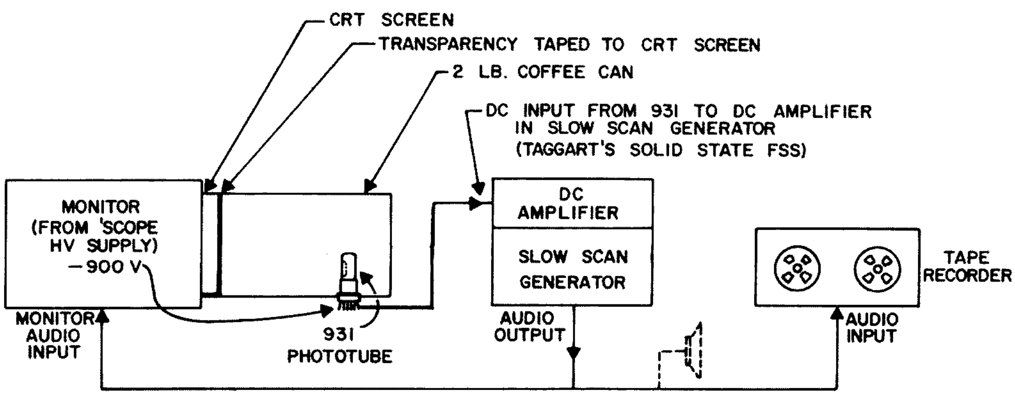
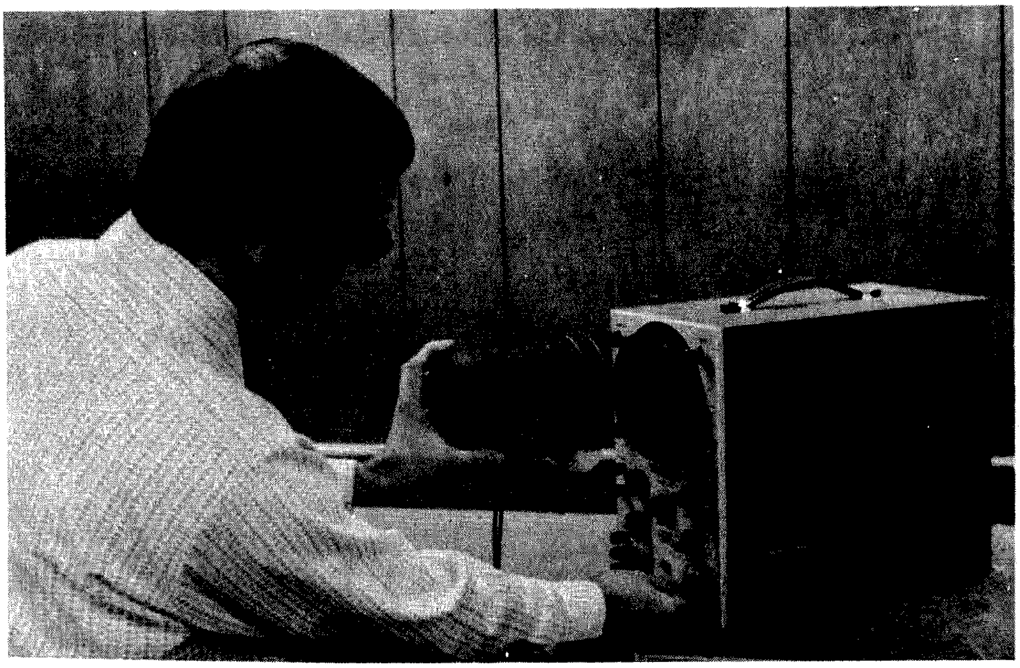


Fig. 1. Block diagram of the can scanner showing connections between the units.



"Can Scanner" being put into position for use.

generator is a composite slow scan signal. This is fed to both the tape recorder and monitor inputs. A previously prepared slide is lightly taped to the monitor crt face. Light from the initial trace will pass through the slide and onto the 931 grid. The 931 output is amplified by the dc amplifier and applied to the generator, providing the slow scan picture. This is now recorded for use on the air later. The system has one drawback: since the monitor is used as a "scanner" you cannot see the pictures as they are scanned; you must record them and then view them off the tape recorder. No big thing– after a couple of hours of practice you'll have it down pat.

Be sure to use a good quality (capstan driven) tape recorder, since wow will be doubled by recording and playing back on an inferior machine. Generally speaking, tape recorders that will record and reproduce music will also work fine for slow scan.

Note: One change is necessary in the monitor, so it will continuously sweep white regardless of the slow scan video frequency from the generator feeding it. Either run the contrast control to minimum or disconnect the video lead that modules the crt (usually applied across a 500K or 1 MΩ resistor on the control grid). This is only for scanning. It must be set back as usual for viewing pictures. Your monitor brightness control now doubles as a "scanning contrast" control.

Operation

Now to record pictures, remove the yellow filter on the screen if your monitor has one (the initial trace is used for scanning). Tape your slide or transparency to the screen, place the can with the 931 over this (Fig. 1) and record a few frames. Then remove the can and slide, rewind the tape recorder and play back the recorded pictures

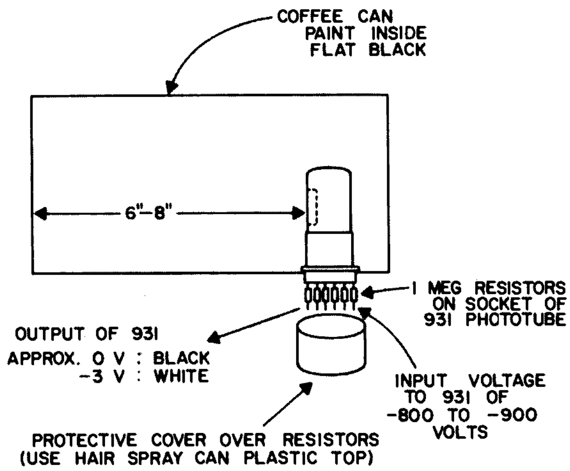


Fig. 2. Coffee can details of the scanner.

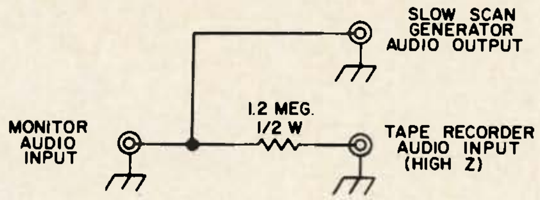


Fig. 3. Matching network between SSTV audio and tape recorder.

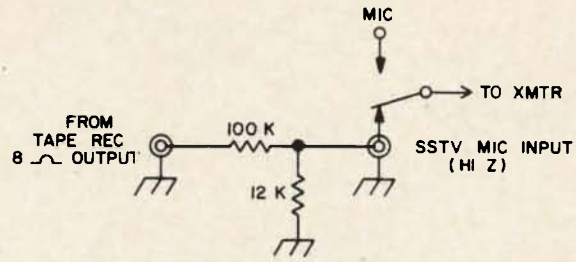


Fig. 4. Matching network between tape recorder and transmitter.

to check detail. This process can be continued until you have a group of programs recorded.

You might like to leave a blank space between each picture and write down, in order, what each "burst" (picture) is, so you can later splice them together in different orders. For example, splice 3 I.D frames to 3 photo frames and follow with 3 sign-off frames. Top this off with paper leader spliced onto the front and end of the "program" and write the description directly on this leader with a pen.

Remember to disable the monitor contrast when recording, and 'o set it back as usual when viewing (so you will view the pictures as others will).

The distance from crt screen to photomultiplier grid is six to eight inches.

The −700 to −900 volts for the phototube can be acquired from the high voltage divider string (probably between intensity and focus pot) of the monitor, as Taggart did, or a separate supply can be thrown together from junk parts (as I did). You could even tap off your transmitter HV supply, since you only need a few mils of current. (Watch your polarities!)

A temporary speaker paralleled with the recorder input will allow you to hear the picture before recording it. With a little experience – listening while watching a picture being scanned, you can approximate the proper setting of the monitor brightness control for proper scanned picture contrast. (It may be necessary to disconnect this speaker while recording due to the drop in tape recorder input level.)

A clear slide with only your call letters in the middle, for example, will sound pure 2300 Hz when the trace is at the top. Then a "cutting through" of the tone (popularly

Off-the-tube photos of the results obtainable with the "Can Scanner."

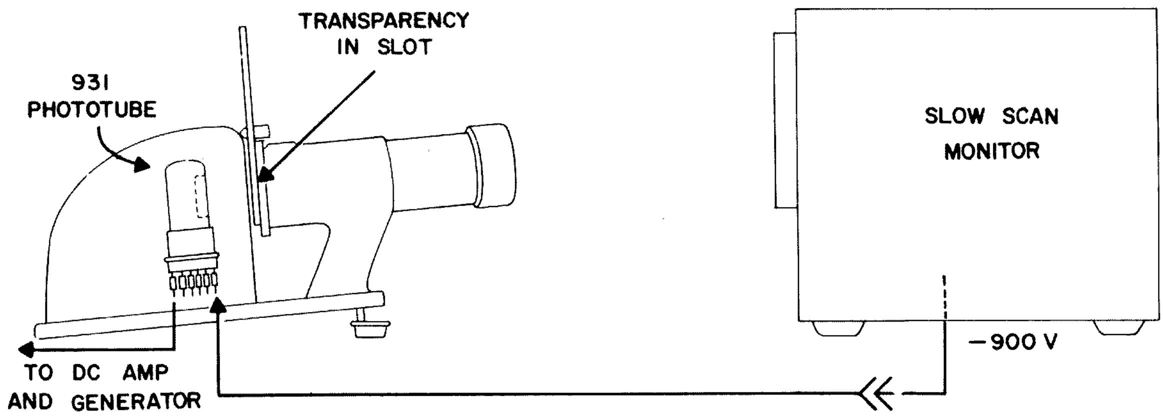


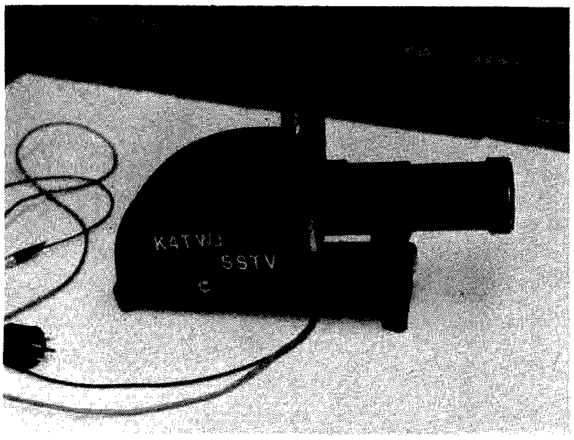
Fig. 5. Improved scanner using a modified slide projector.

referred to as a buzz saw going through a pine knot) as it passes the letters. Then pure 2300 Hz at it nears the bottom.

I mentioned earlier that this system could be expanded. The slow scan plumbicon camera which is featured in the *73 Slow Scan Handbook* uses this same generator. All you need add is the video amplifier, blanker, simple sweep circuits and plumbicon (with its associated power supply) and you have a top-notch slow scan camera.

If you place the two diagrams side by side, you can see the generator is half of the camera, and with this confidence, you'll probably tackle the camera later. Don't forget to keep the coffee can. Maybe the idea will inspire other innovations, or help a new slow scanner into our fascinating world.

The off-the-screen photos show the quality obtainable from the can scanner.



Slide projector "in reverse" ready for use with monitor supplying high voltage for the phototube.

Thanks go to Clarence K6IV for the photography.

A slightly more sophisticated "scanner" is shown in Fig. 5.

The coffee can is replaced with an old slide projector in which the 931 phototube (plus its socket and bank of 1 meg resistors) is centered in the space previously occupied by the projection lamp. The modified projector, with the slide you want to record inserted in it, is now trained on the monitor. (Remember to disconnect the video lead on the monitor's crt grid, so it will just sweep white). Now you can make up continuous programs by just feeding slides into the projector . . . either color, black and white, or home drawn with felt pens on clear plastic 2 x 2 in. squares. I found the best and quickest way to focus this "scanner" was to place a *thin* piece of paper in the slide holder, like it was being scanned, and focus the picture from my 5 inch Sony TV onto this. I did this in a dark room, placing the Sony TV about 14 in. from the projector. When I could see the picture *sharply* on the thin paper, I cut on the lights, and measured my lens length, and distance to Fast Scan (Sony) TV. This, no doubt, saved hours of Slow Scan adjusting. I suggest you borrow a friend's Slow Scan monitor when you set this up the first time, so you can make fine adjustments on focus and scanning brightness, while viewing them on a monitor. When you do get them right, be sure to measure and mark all dimensions.

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IMPROVING THE INDOOR ANTENNA SYSTEM

The use of thin copper sheeting is featured to construct efficient, broad-band indoor antenna systems of either the single-band or multi-band variety.

Having to work with an indoor antenna system inside an apartment or house is, of course, a major handicap. No indoor antenna system will ever work as well as an outdoor antenna system constructed of the same materials, at the same height, etc. However, rather than take the defeated approach to the indoor antenna problem, it is very worthwhile to examine the possibilities concerning what things can be done better with an indoor antenna system than with an outdoor antenna system. After all, using an indoor antenna system, the materials used are not subject to the same wear or stress requirements as those on an outdoor system, the antenna is usually more accessible to make adjustments, etc.

Keeping these thoughts in mind, I decided to explore a somewhat different technique for the construction of an indoor antenna system. One of the chief factors that is desired to achieve in any antenna system is low-loss. That is, regardless of how good the matching is to an antenna system to transfer power to the system, one still wants to keep the basic Ω loss of the system as low as possible. Such a condition insures at least that each delivered watt of power really radiates and also leads the way to the development of a broad-band or multiple-band antenna system which does not require critical tuning.

Searching around for materials to use for an indoor antenna system, I finally found the ideal material in the form of copper sheeting. Of course, most amateurs would have been using such material if it were as readily available as common household aluminum foil. But, with a little bit of effort, one can find an almost similar form for copper The advantages are numerous as compared to the aluminum foil material various amateurs have used for the indoor construction of loop or dipole antenna systems. The losses of copper are far lower and the copper can be directly soldered with ordinary soldering materials. Unfortunately, one can't walk down to the nearest hardware or grocery store and obtain a roll of thin copper. But, it can be found by searching out the various wholesale metal product outlets. If one gets back far enough in the suppliers' chain, it will be found that the metal is sold on the basis of weight. In my case, hard drawn copper sheeting about 12" wide and 4/1000" thick was found selling at about $2 a pound. The total cost would depend upon the length of sheeting purchased. For a typical 3 band antenna system (described later), the cost was about $10. The 4/1000" material is by no means as

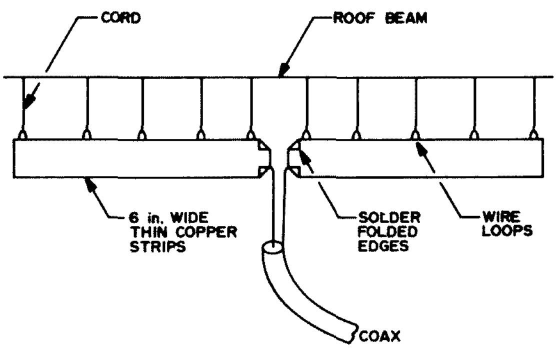

Fig. 1. Basic dipole constructed from thin copper strips.

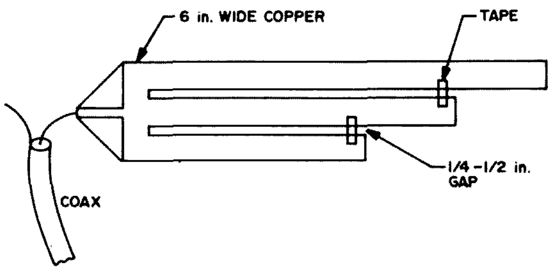

Fig. 2. One half of a tri-band dipole.

fragile as it sounds when one considers that regular foil is still only a fraction of this thickness. One may ask, why fuss to obtain such copper sheeting or foil when, if copper is so desirable, copper tubing is readily available from plumbing supply houses. The advantage of the sheeting is that one obtains far greater surface area for less cost with the sheeting and it is far easier to handle and form in different antenna shapes.

A Practical Antenna

One of the simplest but most effective indoor antennas which one can construct if space is available in an attic is an ordinary dipole. In my case, one dipole antenna which was constructed is shown in Fig. 1. The 12' wide copper sheeting was cut with a pair of heavy shears to two strips of 6" width and each strip used as the arm of a dipole. Little loops of wire were soldered to the top edge of each sheet at intervals and these loops used to attach plastic cord which in turn was used to suspend the antenna from a roof beam, at about a 12" spacing from the beam. At the center of the antenna, the copper strip was folded together towards the center where the coaxial feedline was attached. The folded over edge of the strips was soldered along each edge to the body of the copper strip. This was done to insure absolutely minimum resistance at this high current portion of the antenna. The copper strips were first cut to "formula" length for a regular dipole on the band being used. However, there is no way to predict exactly how much longer the antenna will be than required. One has to use an swr meter in the feedline and carefully trim the antenna length down until proper resonance is found. This procedure is easily done with a pair of shears, trimming the copper stripping down equally at both ends of the dipole until a 1:1, or as close as possible to 1:1, swr ratio is achieved in the center of the band for which the antenna is cut. This procedure requires patience but it is absolutely essential. One of the greatest faults made with indoor antenna systems of the self-resonant type is that many operators forget that the capacitance of the building structure surrounding the antenna completely changes its resonant frequency. The antenna must be cut for resonance where it is mounted or one will end up blaming the indoor location for poor performance results which are not really justified.

A Multi-Band Antenna

The use of the copper stripping to construct an indoor antenna really demonstrates its versatility when constructing a multiband parallel dipole type of antenna system. The multi-band type of antenna about to be described can really be made for any combinations of bands, although the space available in most indoor situations will allow it to be constructed for only 20, 15 and 10 meters or some two band combinations of these bands. The basic multi-band antenna is constructed for the lowest frequency band to be used the same as the antenna shown in Fig. 1 and tuned up for operation on this band. Then each side of the basic dipole is cut using shears to form either two or three strips out of each dipole side as shown in Fig. 2. Try to cut the copper so there is about a 1/4" gap between the strips. Now, if the basic dipole were cut for 20 meters, the center strip would be cut back equally on each side of the dipole until the antenna resonated properly on 15 meters. Then the

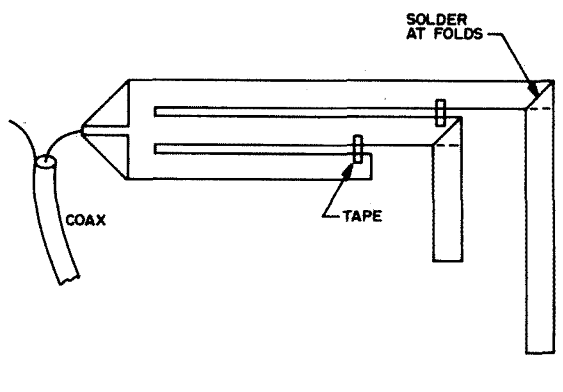

Fig. 3. A space-saving version of the multi-band dipole element of Figure 2.

bottom strip would be cut away equally on both sides of the antenna until the antenna resonated properly on 10 meters. Little pieces of tape placed periodically between the strips will be more than adequate for physical support. The large area surface of the antenna is such that trimming of the strips to form dipoles on each band does not appreciably affect the resonance on any one band. However, one should recheck the resonance on each band. Corrections, if necessary, are easily done by soldering on a few inches of copper stripping cut off during the tuning process on each end of the dipole strip. Solder on these correction strips vertically on the end of each dipole strip.

The same procedure can be used to construct almost any form of dual or tri-band antenna when there is sufficient space to run a dipole on the lowest frequency band being used.

Variations

The ease with which the copper stripping can be bent and, particularly, soldered makes it possible to vary the construction of an indoor antenna to suit almost any situation. For instance, as shown in Fig. 3, if not enough space is available to run out a full length dipole, the dipole strips can be bent to hang vertically at the end of the antenna to make up the necessary length. Inductively loaded or trap antennas are also easily constructed by soldering the necessary components between sections of the copper stripping. A 80-10 meter loop antenna can be formed as shown in Fig. 4 by constructing as large a loop in the attic as space will permit to be hung and using a trans-match type of tuner to resonate the system. Don't hang such a loop horizontally unless it is relatively small and operation is desired only on the 80 or 40 meter bands. The reason for this is that the dominant radiation from a loop will either be broadside to the plane of the loop or along the plane of the loop or a combination thereof depending on the relationship of the loop size in wavelengths to the frequency being used. A horizontally placed loop operated on the higher frequency bands might well operate in a mode such that the dominant radiation is wasted because it is straight up and down.

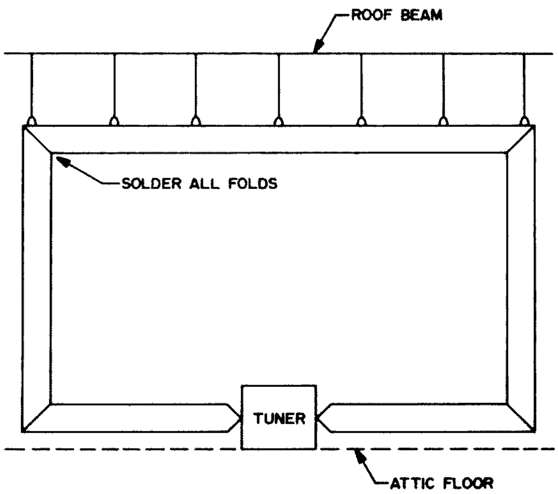

Fig. 4. A multi-band loop for suspension in an attic.

Baluns

The use of a balun for an indoor antenna system is highly recommended. There are usually enough problems with rf fields with indoor installations because of the close proximity of the station equipment and the antenna that it doesn't pay to aggravate it by additional "rf on the feedline" problems. Inexpensive home brew or kit-type toroid baluns can be used since no weather protection is necessary. I used a kit-type toroid balun placed directly between the dipole elements at the center. The toroid winding ends were soldered directly to the copper stripping which formed the dipole and to the coax feedline.

Conclusions

The usage of indoor antennas is also often associated with lower power operation so that one suffers a double handicap. The use of copper stripping as described goes just about as far as one can economically go in keeping antenna losses low. So, if one can match whatever power is available correctly to the antenna, at least one source of loss can be minimized.

A word of caution when handling copper stripping, especially the hard-drawn type. With normal care, there is absolutely no problem handling the material. However, the edges when cut with shears can become like knife blades. Keep the kids away or tape the edges.

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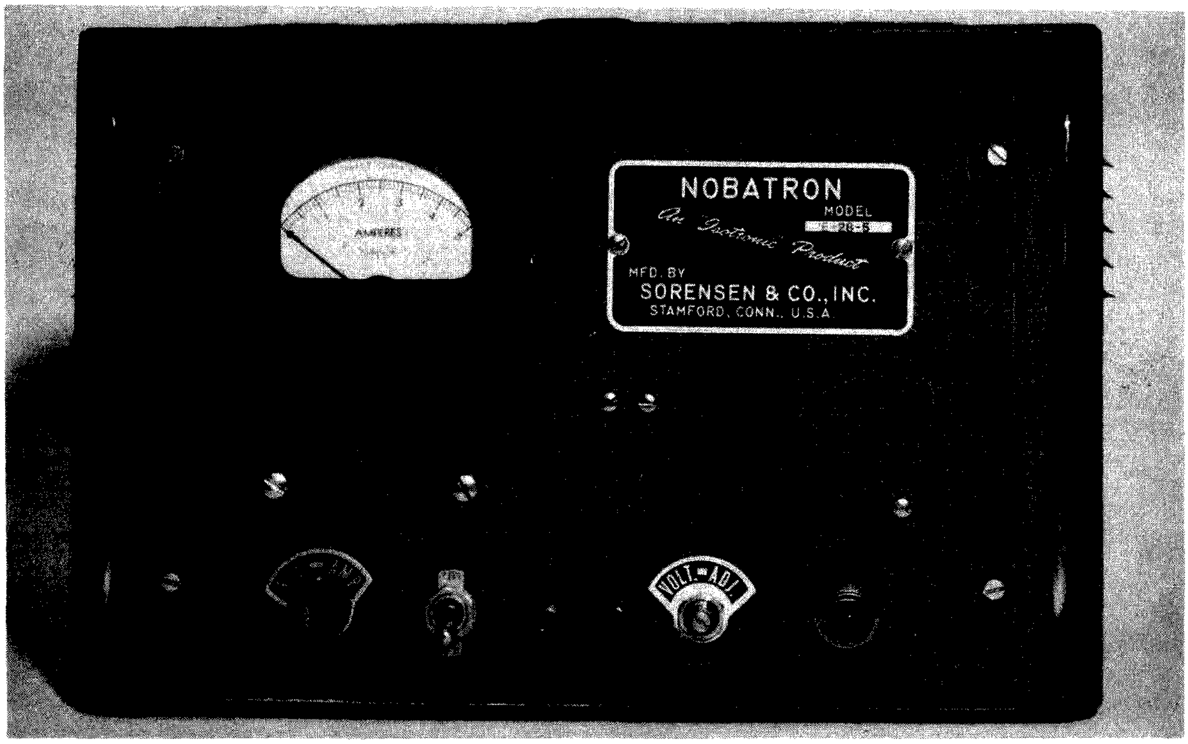
UPDATING SORENSEN "A" NOBATRONS

Prior to the transistor era, regulated low voltage dc power supplies were difficult to build. At the same time, there was not a great demand for such supplies since electronics meant vacuum tubes. The main use of high current, low voltage dc supplies was for either battery-charging or electroplating, neither of which requires superb regulation or ripple reduction.

The Sorensen "A" Nobatron E-28-5 is typical of pretransistor low voltage supplies. It is bulky and heavy, constructed of disc-type rectifiers and saturable reactors, and has very slow response to line or load variations. Perhaps the most serious problem with having an old "A" Nobatron is the possibility of failure (and consequent high cost of replacement) of the sensing diode.

In the E-28-5, a 2AS15A sensing diode was used, whose replacement cost is about $10.00. I don't mean to knock the principle of using a temperature-limited diode to sense "true-rms" voltage, because it is one of the *best* methods. The trouble is that the time constant of the diode filament is the main factor in the slow response of the system, and the tubes are solely available from Thermosen at relatively high cost.

In updating my E-28-5 Nobatron I salvaged only the power transformer, choke, and electrolytic capacitors (plus a few peripheral components like the switch and fuse holder). This may seem like "jacking up the



The updated E-28-5 Nobatron.

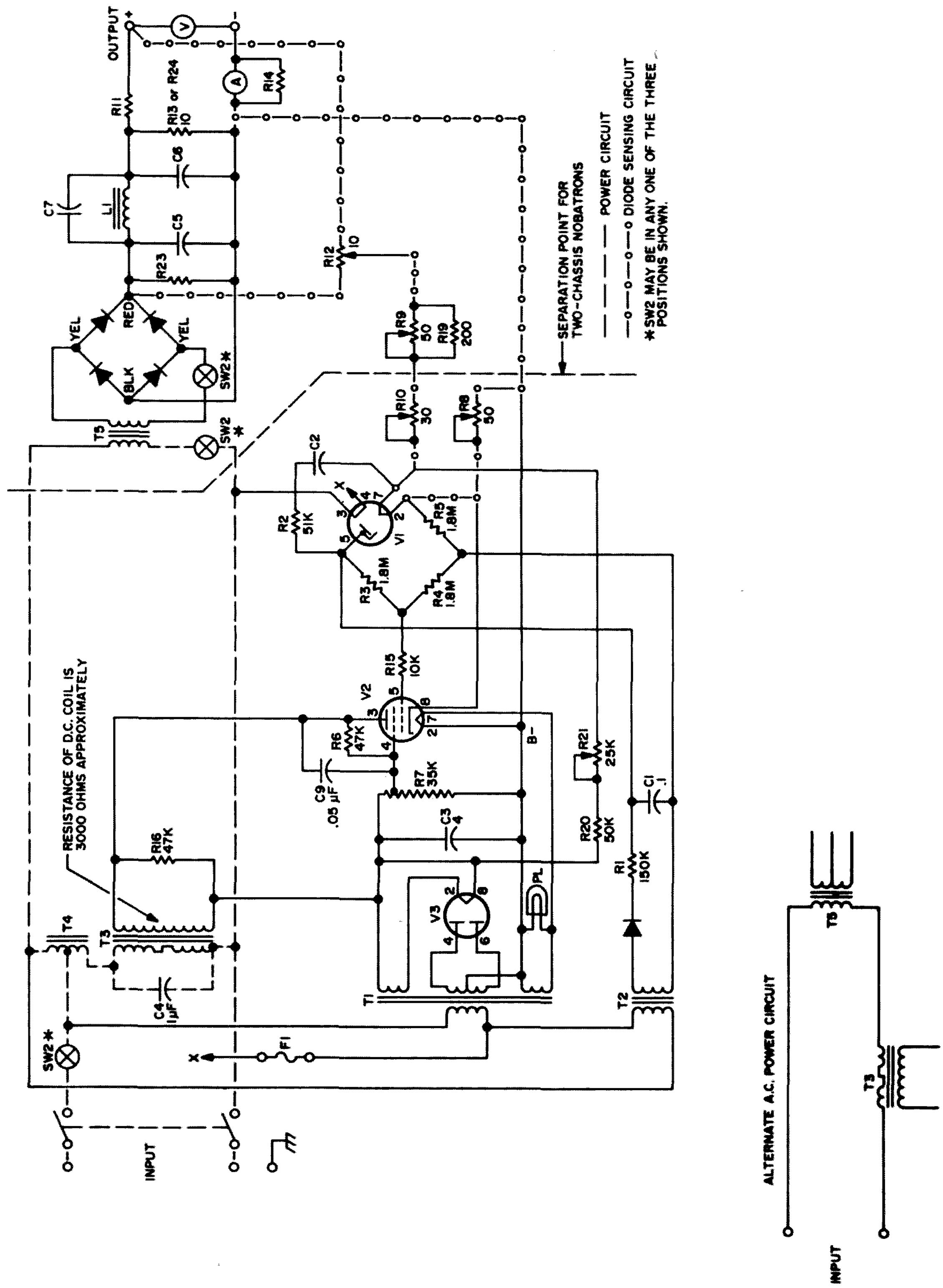


Fig. 1. Circuit used in conversion of the E-28-5.

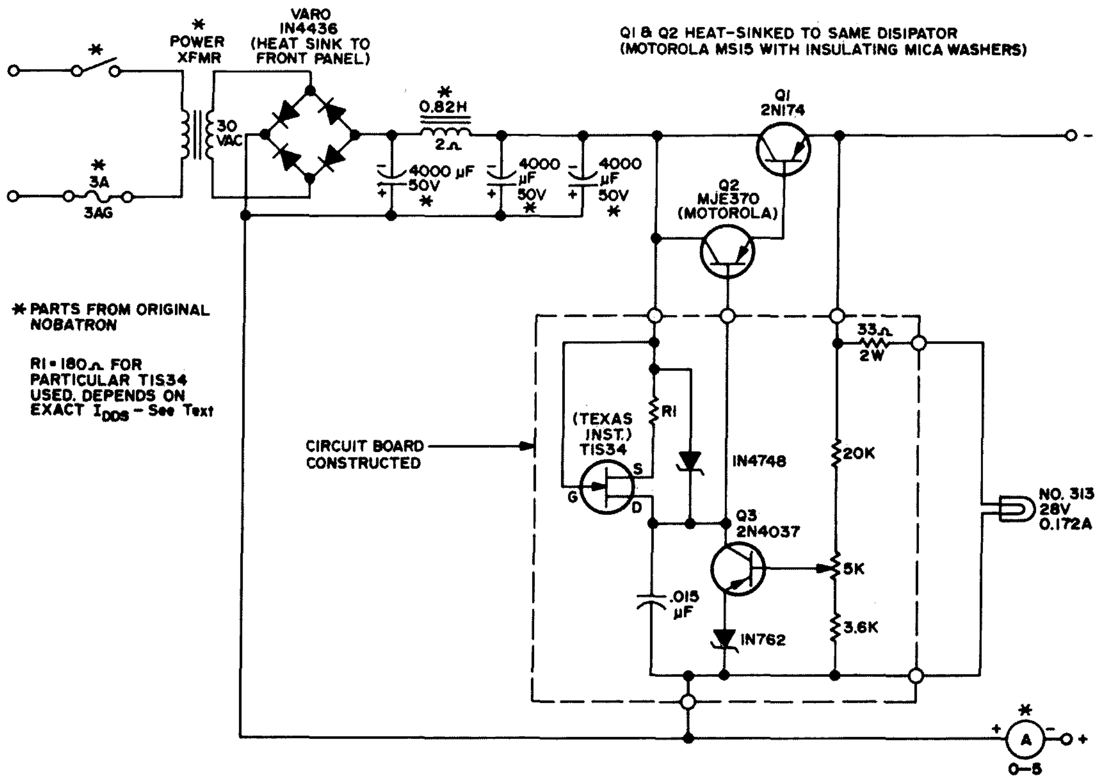


Fig. 2. The rebuilt Sorensen E-28-5.

radiator cap and moving a new auto under," but the components salvaged represent three-fourths of the cost of the new supply.

Table I shows the various types of Nobatrons that one may encounter; the conversion principle shown here for the E-28-5 is generally applicable to any of these. One of the startling improvements is the reduction in size and weight. For instance, the finished E-28-5 (photo) weighed in at 30 pounds, some 35 pounds lighter than when the modernization was started. There are a couple of "A" Nobatron models with output current ratings of 100A or more; even these models might be converted, say by using a pair of the newer high current transistors like the RCA 2N5575.

In the conversion of the E-28-5, a simple transistor series regulator in the secondary circuit replaces the old saturable reactor regulator in the primary circuit. A PNP negative-side regulator was used, but it could have as easily been made an NPN positive regulator. Figure 1 shows the actual circuit.

The circuit uses an FET as a constant-current source to provide the load resistance for Q3. In this way, a much higher dynamic load impedance for the dc amplifier (with consequent higher dc loop gain) is obtained. The FET is picked to have an I_{dss} higher

TABLE I
Weight and Input Currents

Model	Net Weight Lbs.	Input Current Amps.
E-6-5A	65	2.5
E-6-15A	65	4.5
E-6-40A	90	10
E-6-100A	230	26
E-12-5	70	3.0
E-12-15	75	7.0
E-12-50A	170	23
E-28-5	65	6.0
E-28-10	70	10
E-28-30	180	28
E-28-70	475	35
E-28-150	500	31
E-48-15	230	28
E-125-10	200	33
E-200-5	240	33
DE-6-40	65	10
DE-12-10	55	6.0
DE-28-10	60	10

Information on different types of Nobatrons. Code: Number following "E" indicates voltage. Number following voltage indicates current.

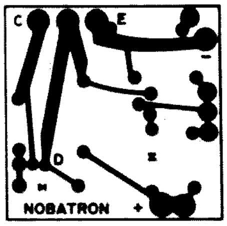


Fig. 3. Circuit board for smaller components.

than 6 mA (the value of constant current desired in this circuit) and then the value of R1 adjusted to give the correct value of constant current. Since I_{dss} for the TIS34 is specified from 4–20 mA, a few from "off the shelf" will have insufficent current, but TIS34's are only about $1.00 each.

A 22V zener diode is placed across the FET constant current source to protect it from transients, since it has only a 30V rating. The two series transistors (Q1 and Q2) are wired in the Darlington configuration, and mounted on the same heat sink.

A simple circuit board has been laid out to accommodate the smaller components.

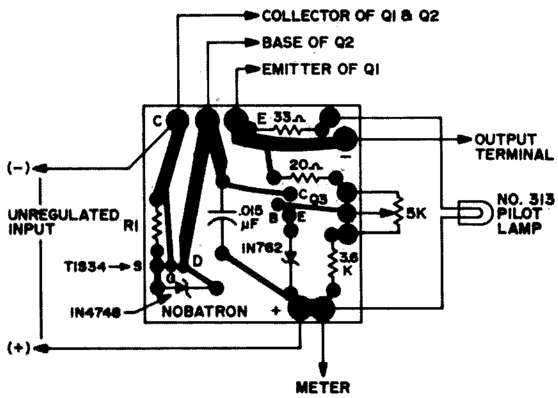


Fig. 4. Parts placement on circuit board.

This board is shown in Fig. 3. Boards and parts are available from Project Supply Co., P.O. Box 555, Tempe AZ 85281.

Further information on the type "A" Nobatron is available from Sorensen (a division of Raytheon), Richards Avenue, South Norwalk CT; ask for publication No. 106A. The Sorensen Company still uses the "Nobatron" trade name for their extensive line of solid state low voltage power supplies.

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FM DEVIATION METERS

Build your own with an FM receiver and oscilliscope

One of the most important elements of amateur growth has been the use of VHF FM. Its growth has surpassed most predictions as Japanese and American manufacturers are flooding the market with excellent quality two meter equipment.

Most of us grew up with AM, the old standby. Unlike amplitude modulation, the term percentage modulation means very little in FM practice. In FM we use the term deviation when the transmitter is modulated, the carrier shift is in frequency on either side of its center frequency. This is called deviation. Deviation is normally measured in kHz, and in a properly operating FM transmitter it will be directly proportional to the amplitude of the modulating signal. When a symmetrical modulating signal is applied to the transmitter, equal deviation on each side of the carrier frequency is obtained during each cycle of the modulating signal, and the total frequency range covered by the FM transmitter is known as swing; e.g., a transmitter operating on 5000 kHz is shifted to 4990 and then to 5010 kHz. It is deviating ±10 kHz and has a swing of 20 kHz). To measure this swing requires special test equipment. There are two main types of deviation meters: one employs a meter to read the peak deviation and the other uses a cathode ray tube.

Deviation Meter Utilizing A Meter

The Lampkin FM modulation meter is shown in Fig. 1. It is completely tunable and will measure peak frequency deviation either positive or negative. Here's how this works. A signal from a transmitter to be measured is picked up by the antenna and fed into the mixer along with a VFO whose output, or harmonic, when adjusted will produce an i-f frequency. The i-f amplifies the signal and its output is fed to the limiter which cuts down the signal to a fixed level of voltage, free from amplitude modulation or variation due to input strength. The discriminator changes the frequency change to a proportional dc change. An on-frequency signal would produce zero volts directly from the discriminator load resistor. The audio voltage is impressed on the cathode follower tube. The purpose of the follower is to provide a low source impedance for charging the input capacitor of a shunt fed rectifier. The time constant is such that the rectifier charges quickly and accurately to the instantaneous peaks of modulation just long enough for the indicating meter to respond and to be

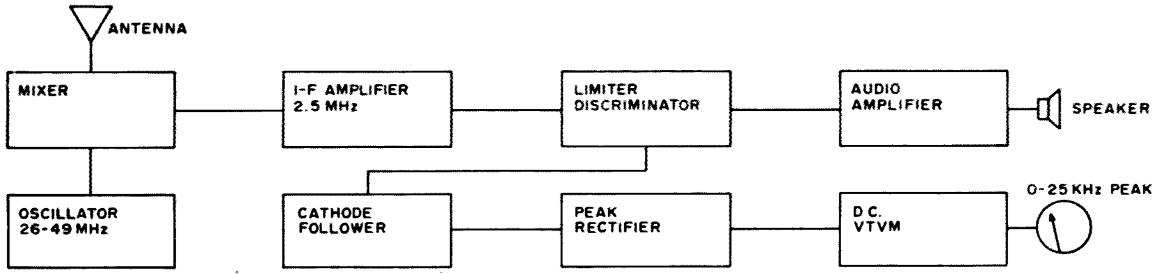

Fig. 1. Block diagram of Lampkin type 205A FM modulation meter.

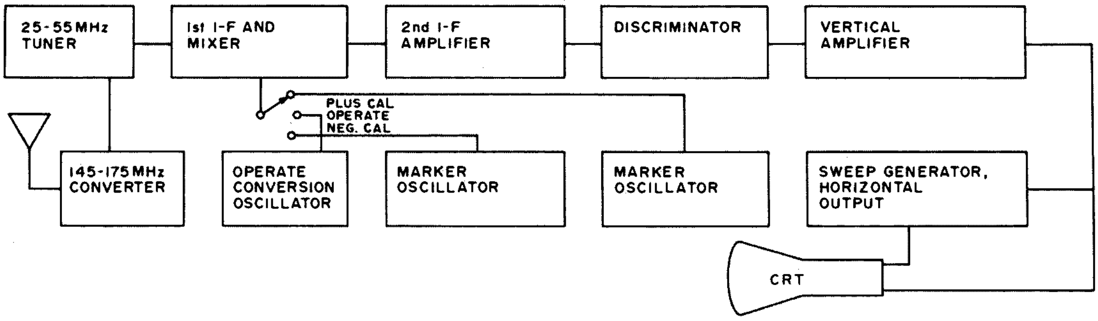

Fig. 2. Block diagram of Radio Specialty Mfg. No. 1163.

read accurately. The meter is calibrated for peak swing on the transmitter.

Deviation Meter Utilizing a Cathode Ray Tube

The Radio Specialty Deviation meter is shown in Fig. 2. The deviation meter is basically a tunable FM receiver and a direct coupled oscilliscope in one package. Peak deviation can be seen visually by calibrating the face of the cathode ray tube. By modulating a transmitter with a sine wave and watching the deviation meter distortion and limiting, if any, can be seen. Calibration of the unit is achieved by the use of marker oscillators 10 kHz above and below the operating frequency of the second oscillator. The vertical gain of the vertical amplifier can then be set to correspond with the markings on the face of the CRT.

Building Your Own Deviation Meter

The deviation meter just described can be built by using an FM receiver (fixed or tunable) and an oscilloscope with a vertical amplifier which is direct coupled. A narrow band receiver is superior to the broad band because of the increased discriminator sensitivity to frequency change. Calibration can be accomplished a number of ways. Figure 3 shows a block diagram with the calibrating oscillator. This oscillator should be tuned either 10 or 15 kHz above or below the second oscillator. The cathode ray tube face can then be calibrated accordingly. One calibration oscillator should suffice since a transmitter usually deviates equally well both ways, however another one would assure greater accuracy.

Operation

1 Switch S1 to normal
2. Turn on transmitter to be checked and tune in signal (or switch proper crystal in). A straight horizontal line will show up which will move up and down with tuning. Adjust for center of the screen.
3. Switch S1 to calibrate. The horizontal line

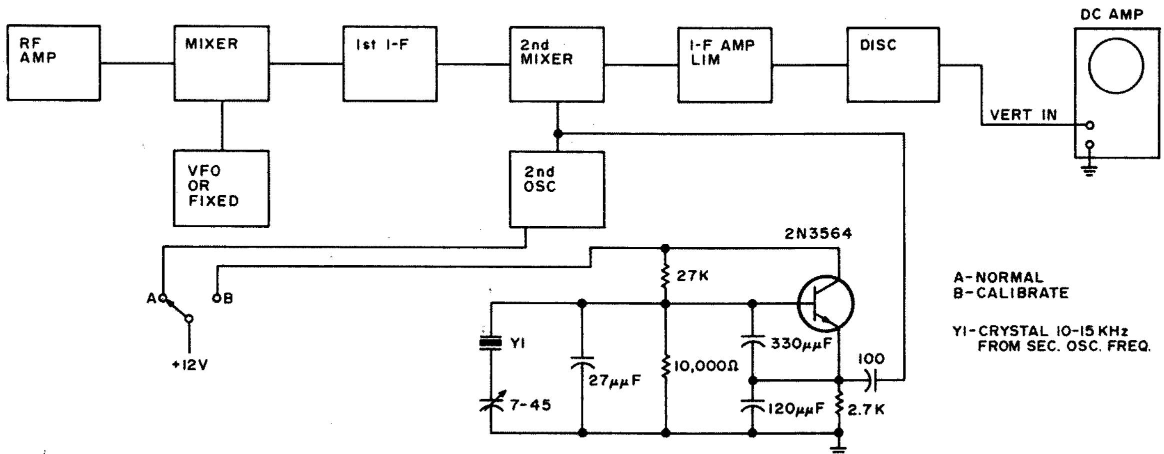

Fig. 3. Block diagram of an easily constructed FM deviation meter using an external oscillator in conjunction with an available receiver and oscilloscope.

will now move either up or down. Adjust vertical gain for a reasonable display and mark on the face of the tube. The unit is now calibrated for deviation limits as determined by the difference of the two oscillators. Additional markings can be added to the face of the tube for lower deviations.

4. Modulate the transmitter to be measured while watching for peak modulation.

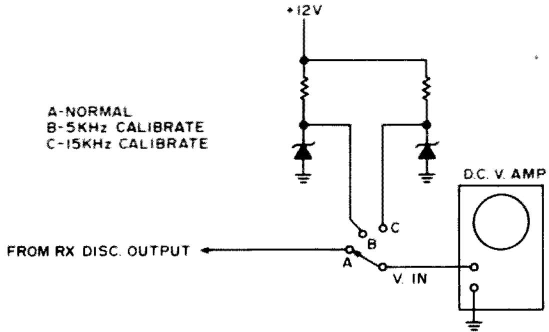

Fig. 4. Alternative circuit using zener diodes to locate the 5 and 15 kHz marks on the scope face.

Alternative Circuit

The calibration circuit as shown in Fig. 4 can be used if desired. A signal generator must be fed into the receiver with a multimeter connected to the discriminator secondary to measure the dc voltage change versus the frequency change of the receiver. Record the voltage at 5 kHz and 15 kHz off. The correct zener can then be selected to supply a reference voltage to calibrate the oscilloscope. If a zener cannot be found with the correct voltage drop then a potentiometer across a higher voltage drop type will suffice.

Summary

An FM deviation meter is a useful addition for the workshop and the hamshack. Overmodulation as on AM will cause distortion. Now you can keep close tabs on the repeater as well as fellow hams' deviation.

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References
1. Radio Specialty Mfg. Co Model 1163 Deviation Meter.
2. Lampkin Model 205A Lampkin Laboratories Inc.

Monroe McDonald K5DUS
4130 Shorecrest Dr.
Dallas TX 75209

TIME-FREQUENCY MEASURING SYSTEM PART III

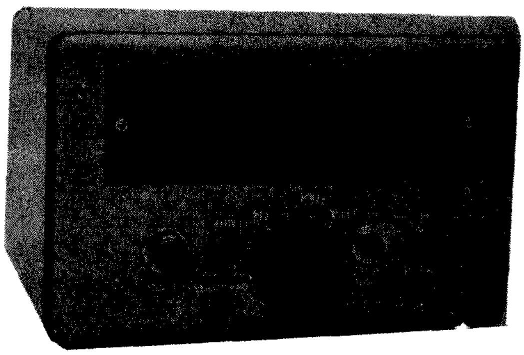
This is the third of a three-part series describing the component parts of a time/frequency measuring system for a well-equipped amateur radio station and workshop. The amateur can calibrate this system to an accuracy of better than one part in 10^6 (.0001%). This system, which was described in detail in the first part of the series, consists of a clock/time base unit and frequency counter unit. The clock is used to calibrate the time base by the time drift method. The counter normally uses the time base in the clock unit for precision measurements, but has provision to operate independently with the power mains as a time reference.

The time drift method of calibrating a precision frequency standard allows the amateur to achieve accuracy far better than traditional methods, without requiring any calibration equipment other than a WWV receiver and his own patience.

Description of Counter

The counter described here has the capability to make precision frequency measurements from 5 Hz to above 220 MHz with more sensitivity than most commercial counters, 20 mV or less over the whole range. The accuracy is that of the time base described before (between .00001 and .0001%). When the power line is used for the time base, accuracy is better than 0.1%.

The display is 6½ digits of seven bar incandescent (no high voltage neon tubes) which is compatible with the accuracy of the instrument. Some other counters have 7 or 8 digit displays that are pure bluff if they don't have the 10^7 or 10^8 accuracy time



bases that such displays would seem to represent.

Many other counters have one count errors (which can be significant at low frequencies) caused by the turning on of the gate itself. This counter prevents this by using a very narrow trigger pulse, as explained in detail later. Low frequency errors are further reduced by the use of a Schmitt trigger to get positive switching even on slowly-changing wave-forms, and a ten-second gate for better resolution.

One-second and 0.1-second gates are used for medium and high frequencies, and a prescaler is switched in for upper HF and VHF.

Basic Counter Theory

The principles of operation of this counter may be seen by referring to the block diagram, Fig. 7.

The counter, which may also be called a totalizer or accumulator, is the heart of the frequency counter, hence the name. This section counts all trigger pulses fed to it while it is enabled, then displays the total. By resetting the counter to zero periodically,

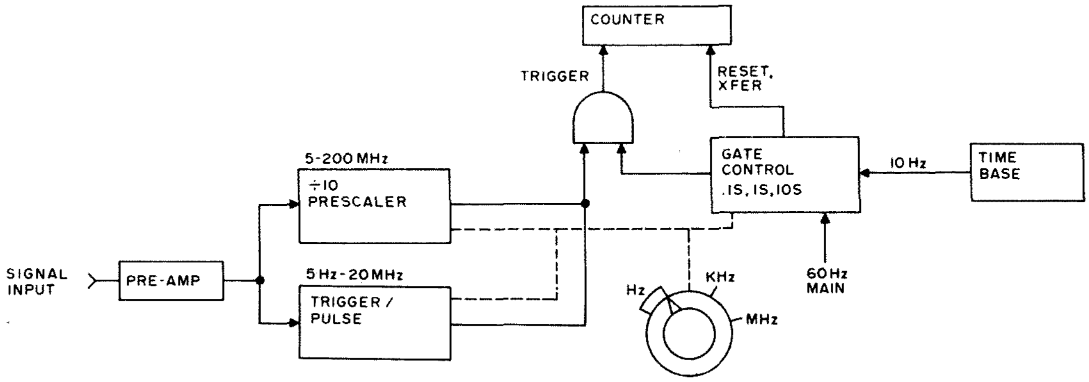


Fig. 7. Overall block diagram of the frequency measuring system.

then allowing it to count for a precise time period, a frequency is displayed. For example, if the counter is turned on (gated) for exactly one second, the total count at the end will be the frequency in cycles-per-second of the triggering signal. After the counting is over, the count is stored in memory units (latches) to be displayed while the counter is reset to start another count.

The gate control section, driven by either the precision time base or the power line, generates the precise enabling gates to turn on the counter. It also generates the transfer pulse to transfer the count to the latches at the end of each counting period, and the reset pulse to put the counter back to zero in preparation of the next count. Longer gates are used for counting slower frequencies, and vice-versa.

The trigger pulses for the counter are developed from the input signal through one of two paths, depending on the frequency. Signals with frequencies of 5 Hz to 20 MHz may be handled by the trigger/pulse generator section. This is selected automatically by selecting Hz (10-second), Hz (1-second), or kHz (.1-second) gating. Signals from 5 to 220+ MHz may be processed through the prescaler by selecting MHz.

The pre-amplifier boosts the signal to a level sufficient to drive either the pulse generator or the prescaler. The frequency response of this section is flat from 10 Hz to 10 MHz, requiring only 10 mV for reliable triggering throughout this range, rolling off at 6 dB per octave above and below. Up to 20 mV is required at 5 Hz and 20 MHz. The prescaler is more sensitive than the pulse generator, so 20 mV sensitivity is maintained up to 200 MHz.

Decimal Point Indexing

The decimal point is set in the display automatically to agree with the gate timing and prescaler division.

In the upper Hz position on the selector switch, a one-second gate is selected and there is no decimal point (assumed to be at the right edge). Here the counter reads directly in counts-per-second (Hz).

When the lower Hz position is selected, a ten-second gate is switched in and the decimal point appears one place in from the right. Ten times as many triggers are counted, so the display reads tenths of Hz.

When the kHz position is selected, the decimal would move in three places, except that the gate is shortened to 0.1 second, cancelling one of those places. Thus the display has a decimal point in two places from the right and reads hundredths of kilohertz (to nearest 10 Hz).

When the MHz position is selected, the decimal would move three places more to the left from the kHz position, except that the divide-by-ten prescaler is switched in, cancelling one of those places. Thus the display has a decimal point in four places from the right and reads ten-thousandths of MHz (to nearest 100 Hz). No accuracy is lost by not having finer resolution as ±.0001% of 200 MHz is ±200 Hz which is the accuracy of the time base.

Overflow

The ½ of the 6½ digit display is a 1 which may appear to the left of the six full digits. This is connected to the overflow counter to show that the count exceeded the six-digit capacity of the counter. I chose to use a "1" instead of another kind of indicator because

throughout most of the range of the instrument an overflow *is* a 1 so the display reads correctly, and adding the 1 to the six-digit display costs very little. This reads incorrectly only if the count exceeds 200 MHz in the MHz position, 20 MHz in the kHz position, 2 MHz in the Hz position, or 200 kHz in the low Hz position. In the last three positions simply selecting the next higher range will show if the 1 is correct.

Leading-Zero Suppression

A nice, though not necessary, feature in this counter is blanking of unneeded zeros on the left of the display. With this blanking, for example, a 400 Hz frequency would read out "400" and not "000400." Logic for this function is provided already in the display decoders so it is a "free" feature.

DESIGN THEORY

Counter-Latches

The counter consists of decade counters, latches, decoders and displays as shown on Fig. 8, detailed block diagram. The operation of all these except the latches was covered in detail earlier and will only be reviewed here.

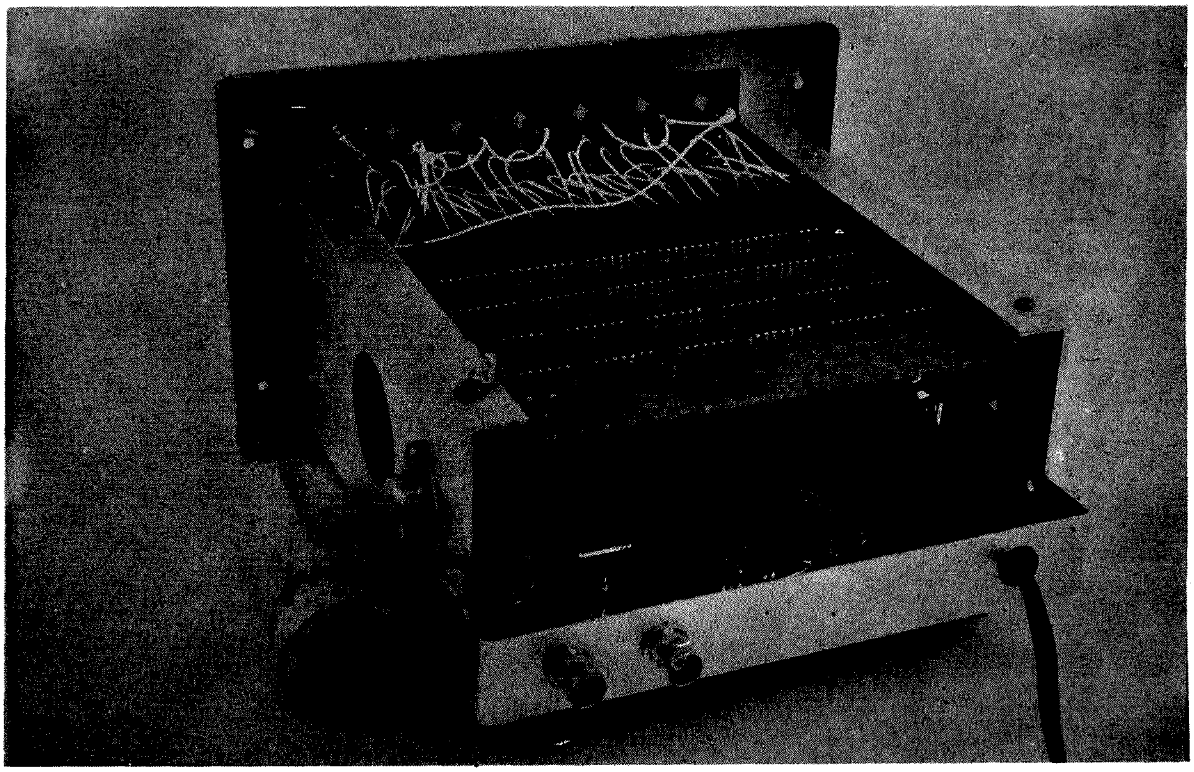
The decade dividers are 7490 integrated circuit (IC) modules, connected to divide by 2 before 5 so as to count up in standard binary-coded-decimal (BCD). Six decades are used, one for each full digit.

A faster-than-normal 20 MHz 7490 must be selected for the critical first decade. The specs. only guarantee 10 MHz, which is good enough for all other places.

The latches are 7475 quad latches, meaning there are four type D flip-flops or memory elements in each IC.

A type D (data) flip-flop has two inputs, D and clock. It stores the D input at the instant the clock switches up. Here, a clock pulse occurs immediately after a count is finished, transferring the count data from the decade dividers to the latches. Then the latches hold the data to be displayed while the dividers are free to do the next count.

The decoders convert the BCD data to the code used by the displays. There are several display/decoder combinations available, as discussed previously. I have used the



The rear view of the counter shows the perf-board construction used by the author. The board along the rear edge is the input circuitry and pre-scaler. The power supply is at the left side with the regulator using the side itself as a heat sink.

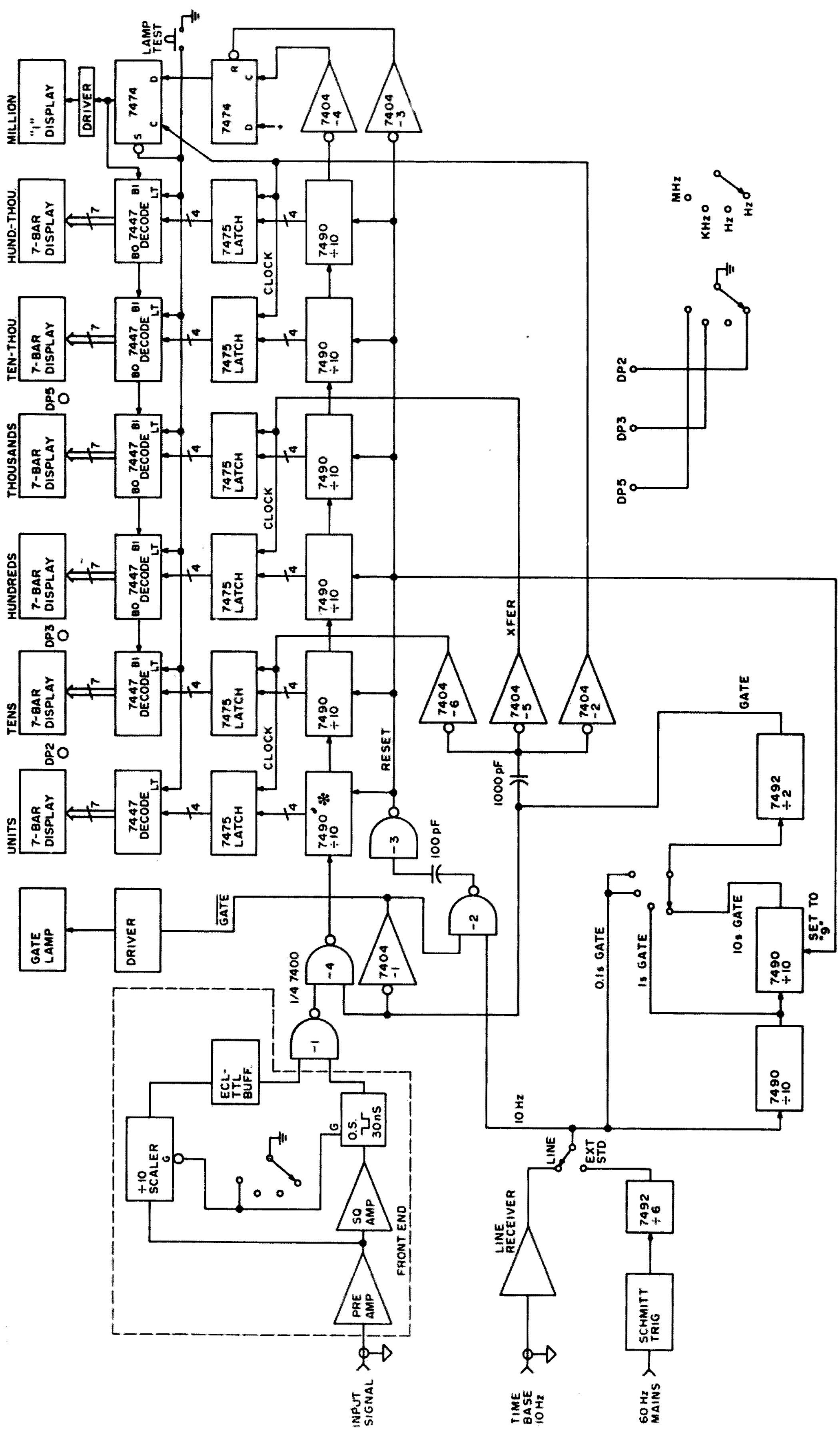


*Fig. 8. Detailed block diagram of the frequency counter. The 7490 identified by * should be selected for > 20 MHz switching speed.*

popular seven-bar segment with low-power lamps, and the corresponding 7447 decoders.

The leading-zero blanking described is implemented by connecting the blanking input (BI) of each decoder to the blanking output (BO) of the next higher digit, or to the overflow bit at the high end. If the overflow bit is a zero (0 volts), it enables the BI input of the Hundred-Thousands decoder. If the HT digit is also a zero, internal logic in the 7447 decoder will blank all lamps in that display and put out a zero on the BO output, passing the blanking signal to the next lower digit. Thus a zero on any BI input indicates that all higher digits are zero. If the BI input is a one (4 volts) then that decoder will display a zero in the normal manner.

Overflow

As discussed above, an overflow detector is used to indicate when the count has exceeded the capacity of the counter. This is like another 1-bit counter except that it only counts up once; i.e., continued or excessive overflowing causes no further change.

A D flip-flop is used as the overflow counter. The D input is permanently wired to a "1" signal so the flip-flop always goes to a 1 when it is clocked by an output from the last decade divider. It is reset at the end of each count with the decades.

Another D flip-flop is used as a latch for the overflow bit in the same manner as for the rest of the display data. A 7474 dual D flip-flop puts both functions in one IC.

Time Base 10 Hz Generation

Because the shortest gate period used in the counter is 0.1 second, the time base signal used must be 10 Hz or faster. A 10 Hz signal is available in the time base unit and also may be derived easily from the 60 Hz power line with the divide-by-6 section of a 7492 IC (7490 for 50 Hz). Selecting a 10 Hz signal to drive the gate control section thus makes a convenient way of selecting time bases, and only one coaxial cable is necessary to connect the time base unit to the counter unit.

A line receiver is used to convert the low voltage 10 Hz signal on the 90 ohm coaxial cable to the standard TTL logic signals used in the gate control logic. Main power from the power transformer secondary is coupled to a buffer gate which develops the 60 Hz time base signal.

Time Gate Generation

7490 decade dividers are used to derive the 1-second and 10-second gates from the 10 Hz signal, while the 0.1-second gate comes directly from the 10 Hz line. The actual gate itself (GATE) is generated by a divide-by-2 counter. This makes symmetrical gating for the 0.1 and 1 second gates, meaning the divider is true (gate on) for one time base period, off for one period, on one, etc. To avoid waiting so long between gates on the 10-second gate, the decade divider that generates this long gate is short-counted during the off period. The 7490 IC has a reset-to-9 feature which makes this possible. At the end of each gate (on) period, a reset pulse is developed to put the counter back to zero to be ready for the next count. This pulse also sets the 10-second divider to 9 so it only has to count one more second to begin a new gate.

A gate lamp on the front panel indicates when the gate is on. This is a useful feature to show that the gate is working properly, and for the longer gates, shows when a count is completed so the input signal can be switched or disconnected.

Transfer Pulse Generation

A transfer pulse is needed immediately after each gate is over to transfer the data from the six-digit counter to the latches. The inputs of the latches are permanently connected to the BCD outputs of the counter, so it is only necesary to feed a positive XFER pulse to the clock inputs of the 7475 latch IC's to accomplish the transfer.

The negative-going trailing edge of the gate is differentiated by capacity-coupling to a TTL gate input, thus developing a short pulse. Multiple gates are required to "fan-out" the pulse to drive the thirteen latch clock inputs. Each gate will drive up to ten standard TTL load units. Each 7474 clock input is two standard TTL loads, so thirteen clocks represents 26 loads, and three gates are necessary to drive them.

Reset Pulse Generation

The RESET pulse must come some time after the XFER pulse, but some time before the beginning of the next counting period (GATE). This is accomplished by adding the inverted GATE ($\overline{\text{GATE}}$) and the 10 Hz trigger in a NAND gate, then differentiating the output, as shown in Fig. 9.

Note that the XFER pulse occurs as the GATE switches down, and the RESET pulse occurs as the NAND signal switches down in the middle of the GATE off period 50 milliseconds later. The timing shown is for the 0.1-second gate, but pulse generation is the same for all gate lengths, with the RESET pulse occurring 50 ms after the XFER pulse in all cases.

Signal Pre-Amp

The signal pre-amp is a discrete transistor circuit swamped with heavy negative feedback to have a flat, controlled gain response from dc to better than 10 MHz. An input blocking capacitor causes a low-end rolloff down 6 dB at 5 Hz, and internal capacity of the transistors causes a high-end rolloff down 6 dB 20 MHz or above. The result is a reliable triggering sensitivity of 10 mV over the flat range, up to 20 mV at 5 Hz and 20 MHz.

Trigger/Pulse Generation (low frequency)

The low-frequency signals (below 20 MHz) are processed through a discrete Schmitt trigger squaring amplifier and then through a 9601 IC one-shot pulse generator. The maximum frequency of this circuit is limited by the toggle rate of the one-shot. At 20 MHz (period 50 nanoseconds) the 30 ns pulses from the one-shot are beginning to run together. The output of the O.S. is normally high, with 30 ns-wide negative pulses at every positive zero-crossing of the input signal. When MHz is selected, the O.S. gate is grounded, locking the output high and enabling the scaler output to be passed through the summing NAND gate.

Pre-Scaler (high frequency)

A 95H90 IC divide-by-ten prescaler is used to divide the signals from 5 MHz to 220+ MHz down to within the counter range. As the basic counter will count to better than 30 MHz, a typical 95H90 can go to 300 MHz, although the manufacturer only guarantees 220 MHz.

The input of the 95H90 is much more sensitive than the squaring amplifier used in the low frequency path, so the pre-amp provides usable sensitivity, even though it is rolling off with increasing frequency. Very light coupling to the pre-amp prevents over-driving the pre-scaler at low frequencies, but prevents the use of the pre-scaler below 5 MHz.

A simple one-transistor amplifier buffers the emitter-coupled-logic (ECL) levels used by the 95H90 to the TTL levels used by the rest of the counter.

The pre-scaler gate, grounded when MHz is selected, allows normal operation of the pre-scaler. When Hz or kHz are selected, the pre-scaler output is locked high enabling the one-shot output to be passed through the summing NAND gate.

Power Supply

The power supply used for the counter is quite similar to the one used in the clock unit, and described in detail previously. In this case I used displays that required a separate power transformer for the lamp supply and electronic power, but this could vary with the builder's display lamp choice.

As before, I used an IC regulator for the 5 volt IC power which is so cheap and simple that there is no other way to go, and unfiltered lamp power, but no batteries are used or needed.

RFI Considerations

As discussed earlier, digital circuitry generates considerable RFI, and equipment using it should be shielded and filtered as in TVI-proofing a transmitter.

CIRCUIT DETAILS

Counter/Latches/Decoders/Displays

Circuit connection considerations for the counters, decoders and displays are the same as given for the clock unit described previously, except for a straight decade counting scheme, as can be seen in Fig. 10. 7490 decade divider IC's U7 through U12 make up the six digits of the counter, with half of U6 being the remaining half digit (overflow "1"). Each is connected with the divide-by-

two (A) section ahead of the divide-by-five (BCD) section for BCD counting.

Gate 4 (pins 11, 12, 13) of quad NAND gate U1 controls the triggers for the counter and is the gate shown in Fig. 7. Gate 1 (pins 1, 2, 3) is the summing gate for triggers from the high and low frequency paths of the front end.

Gated triggers from Gate 4 drive the A Clock Pulse Input (CP 1) of the Units Counter U7. The A output drives the BCD Clock Pulse Input (CP 2), and the D output drives the CP 1 input of the Tens counter U8. Here BCD refers to the B, C, & D flip-flops making up the divide-by-five section, not the BCD counting code. In a like manner the signal progresses through the counter chain Tens through Hundred-Thousands digits. The D output of the last decade U12 drives the overflow counter, section 1 of dual D flip-flop U6, through the inverter 4 of hex inverter U5. This extra inversion is necessary because the 7474 Dual D flip-flops use a positive trigger instead of the negative trigger used by the 7490.

Reset and unused pin considerations were discussed previously. Unused inputs assume a logical "1" state, so the unused reset-to-nine inputs (pins 6 and 7) of the 7490's must be grounded.

The A, B, C and D outputs of the 7490 counters are connected respectively to the A, B, C and D inputs of the 7475 Quad Latches so that the four-bit BCD data from the counters is transferred directly to storage when the latch's two CP inputs are pulsed. The A, B, C and D outputs of the latches are then connected respectively to the A, B, C and D inputs of the decoders.

For testing the lamps in the display units, the LT inputs (pin 3) of all the decoders are grounded. Internal logic in the decoders generates a figure "8" which uses all display lamp segments.

The overflow "1" line is connected to the blanking input (pin 5) of the Hundred Thousand decoder U24, whose blanking output pin 4 is connected to the blanking input pin 5 of the next lower decoder U23 and so on down through U20. This accomplishes the leading zero blanking described earlier.

Overflow

The 7474 IC U6 contains both the overflow and latch flip-flops. The 7474 requires a positive trigger and a negative reset, both the opposite of the 7490, so those signals are inverted by sections 4 and 3 of 7404 IC U5. The D input of the overflow flip-flop (U6 pin 2) is permanently wired to a logic one (5 volts) so that a one will be stored for one or more outputs from the Hundred-Thousands divider. Then when the XFER pulse occurs, the overflow one is transferred to the latch portion of the 7474.

Because the 7474 does not have a current-sinking output like the decoders, a lamp-driver transistor Q5 must be used regardless of the type lamps used.

Time Base

The time base consists of circuitry which delivers a 10 Hz square wave to the Gate Control section. A selector switch determines whether this 10 Hz is derived from the external precision time base or internally from the power mains.

The external time base 10 Hz is connected to the counter unit through a 90-ohm (RG-62) coaxial cable, and appears as a 2-volt square wave on that cable. A line receiver, made up of a 100-ohm termination and a switching transistor Q4, converts this low impedance signal to standard TTL logic levels. A 1K resistor is used to limit base current to Q4.

A Schmitt trigger, made up of Q1, Q2 and Q3, squares the 60 Hz waveform from the power transformer and converts it to TTL logic levels. The 7492 IC U4 divide-by-six section then divides the 60 Hz down to 10 Hz.

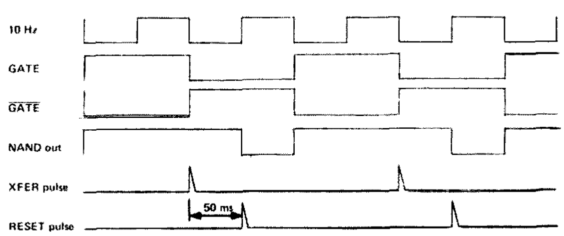


Fig. 9. Pulse timing diagram.

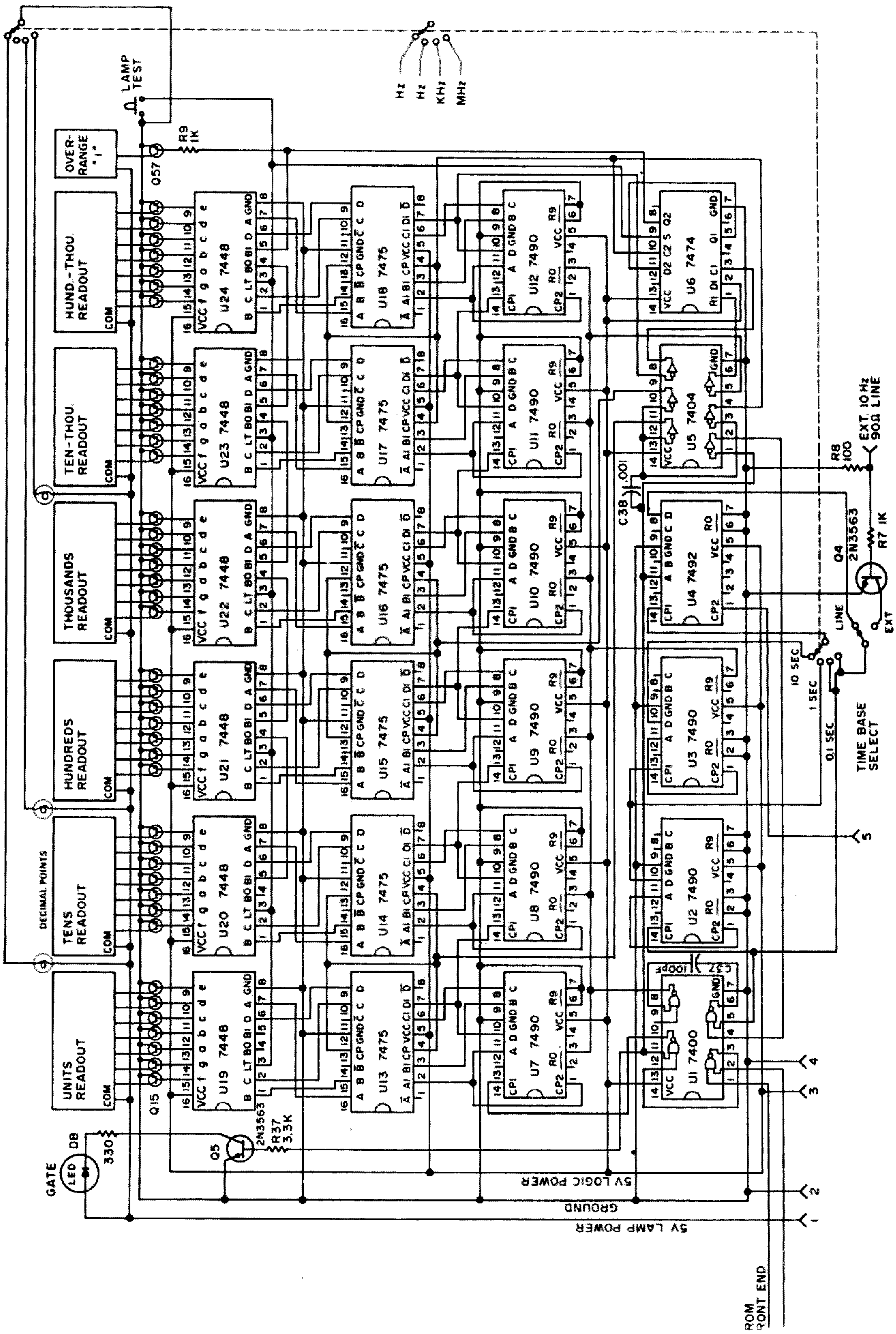


Fig. 10a. Schematic of the frequency counter. Note: C3–C26 are not shown. These are .01 disc ceramics connected directly from Vcc to ground at each IC.

Gate Generator

The gate is generated by the A (divide-by-two) section of 7492 U4. The CP 1 input for this flip-flop is selected by the Hz-kHz-MHz selector switch, and is either the 10 Hz time base signal, or that signal divided by ten or a hundred. The 10 Hz signal generates a gate that is on (logic one) for 0.1 second and off (logic zero) for 0.1 second alternately in the MHz and kHz modes.

In the Hz 1-second mode, the 7490 IC U2 is switched in to divide the 10 Hz to 1 Hz, and the gate is on for one second and off for one second. In the Hz (10-second) mode, the 1 Hz output of U2 is further divided to 0.1 Hz by 7490 IC U3. the RESET pulse from U1 pin 8 is connected to the reset-to-nine input (pin 7) of U3 to short-count this decade when the gate is off. At the end of each ten-second gate on period, the RESET pulse that clears the counter advances U3 to the count of 9 so that only one more count (one second) is required to start the next gate.

Pulse Generators

Inputs to a TTL gate, such as the 7400 or 7404, are emitters of NPN transistors. These must be grounded to cause current flow (about 1.5 mA) to create a logic zero input. An input can either be forced above +2V or left open to cause no current flow and a logic one input.

If a signal with a fast fall time is capacitively coupled to a TTL input, a current pulse is pulled from the emitter as the signal switches down, causing the inverting gate to output a short positive pulse as the capacitor charges. When the signal switches up, the gate input voltage is driven above the supply voltage, causing the emitter to zener, discharging the capacitor.

A 1000 pF capacitor couples the GATE signal to three sections of 7404 hex inverter U5, generating XFER pulses at the end of each gate. Three inverters are required to drive all the loads on the XFER lines, as explained earlier.

NAND gate 2 of U1 generates a down-switching signal 50 milliseconds after the XFER pulse as explained previously and in Timing Diagram Fig. 9. This is coupled to gate 3 of U1, used as an inverter, which generates the RESET pulse. The loads on the RESET line are lighter than those on the XFER lines, so only one gate is required to drive all loads.

Gate Lamp

In my prototype model I used a #47 pilot lamp, but this took a two-stage transistor driver and nearly 150 mA current from the supply. I have since tried the little light-emitting-diode (LED) circuit shown in the schematic and find it does the same job with only one transistor and 15 mA supply current.

Signal Pre-Amp

The schematic diagram for the counter front end, including pre-amp, squaring amp, one-shot and pre-scaler is shown in Fig. 11.

The pre-amplifier is basically a two-stage discrete transistor common-emitter circuit,

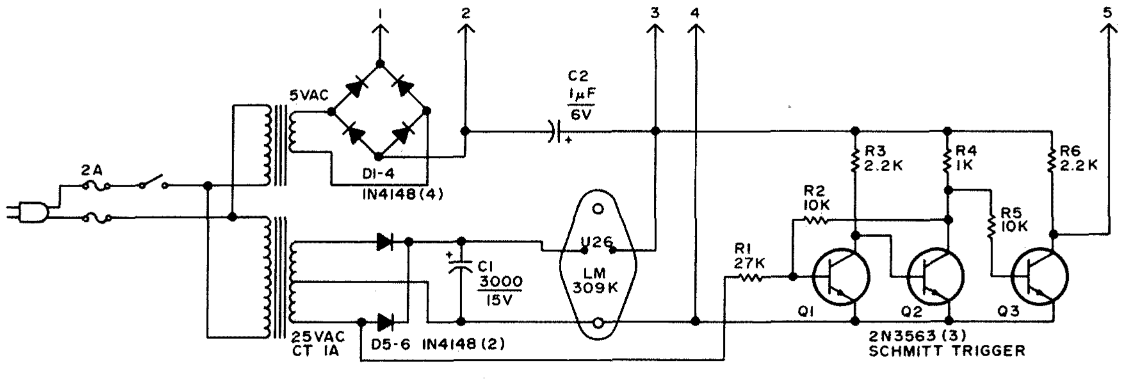


Fig. 10b. Counter power supply. Connections are made via the points numbered 1–5.

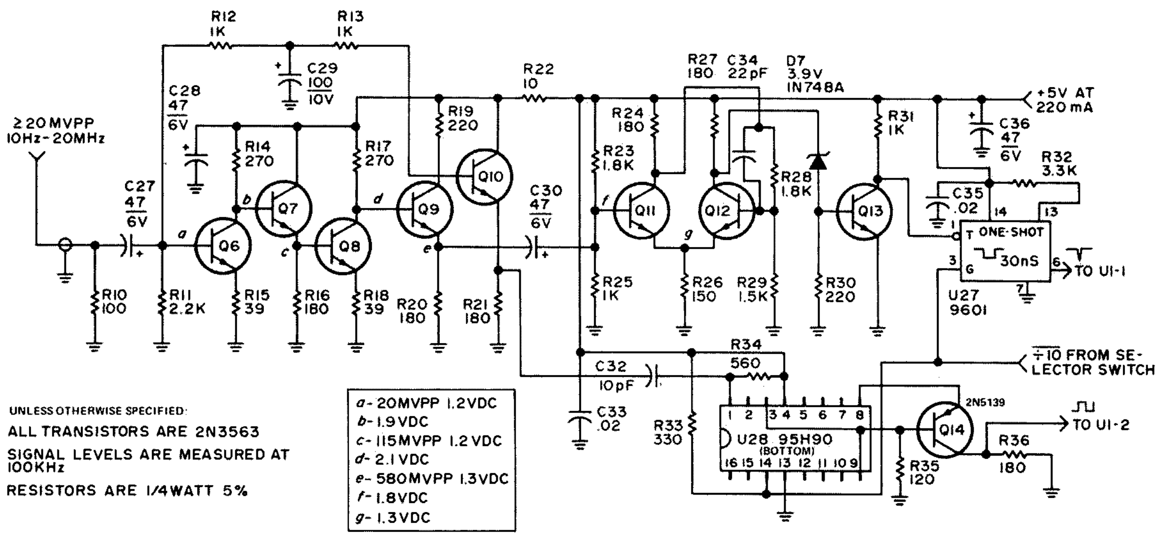


Fig. 11. Schematic of the front end of the counter containing the preamp and pre-scaler.

with emitter-follower buffers used for impedance-matching. Q6 and Q8 are the common-emitter gain stages. The 2N3563 transistors used have an Ft of 900 MHz, making them very good high frequency transistors, but even so at frequencies above 10 MHz their output impedance is so much higher than their input impedance that the emitter follower Q7 is required to match between stages. Emitter followers Q9 and Q10 are used to drive the squaring amp and prescaler, respectively.

Q6 and Q8 have unbypassed emitter resistors R15 and R18. This provides large negative feedback which keeps the amplifier's response flat over most of its useful frequency range.

R12, C29 and R13 form a negative feedback path for dc to stabilize the operating bias of the amplifier.

Squaring Amplifier

The squaring amplifier is a Schmitt trigger made up of Q11, Q12 and their associated circuits. In the absence of a signal, Q11 is biased slightly below cutoff and Q12 is turned on. The voltage divider R24, R28 and R29 holds the bias on Q12 slightly higher than on Q11. Signal voltages applied through C30 have no effect until they raise Q11's bias equal to Q12's; at that point Q11 turns on and the voltage drop across R24 lowers the bias on Q12 causing it to snap off. Subsequently, the signal voltage to Q11 must be lowered below the new Q12 bias point to transfer conduction back to Q12. About one volt of hysteresis is thus obtained.

C34 is used to speed up the switching action, extending the frequency response to 20 MHz.

Q13 is used as a level shifter to couple the Vcc-referenced output of the squaring amplifier to the ground-referenced input of the one-shot gate.

One-Shot Pulse Generator

The pulse generator is a 9601 IC U27 connected for the shortest possible pulse width, allowing operation to 20 MHz. R32 sets this pulse width.

Prescaler-Buffer

A Fairchild 95H90 IC U28 is used as the prescaler. The input has an internal pull-down resistor, so an external pull-up resistor R34 is used to bias the input to just below the point of triggering. 560 ohms was about right for my unit, but this might vary from unit to unit. Setting this bias level high enough for sensitive triggering but low enough to be stable is critical. I was able to achieve reliable triggering with about 30 mV of signal.

The buffer transistor Q14 shifts the logic levels from the ECL levels of the 95H90 to TTL levels for the counter gates.

...K5DUS

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ANOTHER USE FOR 400 CYCLE TRANSFORMERS

Any amateur who has converted surplus electronic equipment has at some time or other ended up with a 400 cycle power transformer which became a paperweight, bookend, or in most instances a gift to the trash collector.

These transformers are not as useless as they may at first appear. In the June 1968 issue of 73 magazine W4UBH published an article on putting them to work in audio circuits. Another use for them that I have not seen written up anywhere is low voltage power supplies. With more and more amateurs experimenting with transistors and integrated circuits, these transformers make excellent low voltage power supplies by hooking them up backwards. That is, connect the 115V to the secondary winding and take the low voltage from the primary winding.

Figure 1 shows the original power supply as it was used on 400 cycle. Figure 2 shows the hookup for use as a low voltage supply from 60 cycles. With the hookup shown in Fig. 2, the voltage between terminals 1 and 2 is 27V with no load. With a load that draws 520 mA, the voltage drops to 23V. The original secondary ratings was 240V each side of center tap at 45 mA. The original ratings give some idea of what voltage and current can be expected in the reverse hookup. At the present time I have plans to make an adjustable power supply using this reverse connected 400 cycle transformer. I will not go into the filtering and regulating circuits; that has been covered in the past issues of 73 and other magazines. One word of caution – don't use a transformer that has any of the original secondary windings connected to the case of the transformer. This could give you a fatal shock should you come in contact with the transformer case and ground.

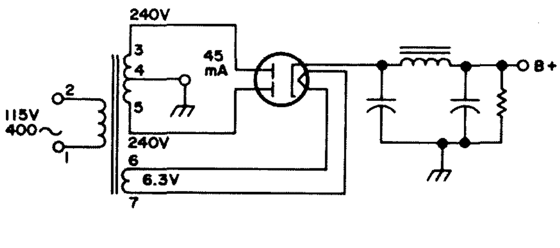

Fig. 1. Original circuit.

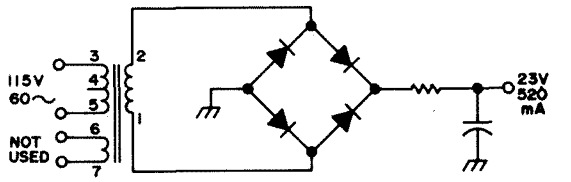

Fig. 2. Reverse connected for low voltage power supply.

...WØNVM

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BANDPASS FILTER DESIGN

With the advent of the "modern network theory" method of filter design, this involved phase of electronic engineering has been greatly simplified. Now almost any engineer can design filters to suit his needs with a minimum of time and effort. I have gone a step further and simplified the procedure even more. The result is a specialized filter type which is ideally suited to pulse inputs (mark-space) and which uses the infamous 88 mH toiroidal inductor which is widely available on the surplus market. Information is given, however, for those who wish to use other inductors (this is necesary when a particular input impedance is specified and one does not wish to link-couple to the input inductor). The design is based on the center frequency, bandwidth, skirt requirements, and available inductor "Q."

About the Filter

The filters I describe are those whose response is best suited to on-off (pulse) inputs. They are characterized by a linear phase delay function across the passband. This has the effect of distorting the pulse shape (leading and trailing edge round-off) and length (minimum ringing) as little as possible for a given bandwidth. The shape of their passband amplitude response, however, is not flat; it is rounded and has no definite 'cut-off" point. This is of little consequence because the signals (mark and space) can be tuned to appear at the center of the filter passbands at the receiver (assuming correct shift is used). These linear phase filters have been used in commercial carrier systems for a long time, on narrow band channels, because of these characteristics.

The network configuration of these filters should be the "high side capacitively coupled resonator" type. The reason for this choice is that it is the only configuration which allows the designer to use the same value of inductance throughout. Since in most cases the RTTY experimenter will have an abundance of 88 mH toroids, this proves to be the only practical choice.

Assuming you will choose to use the 88 mH toroids and therefore tolerate any reasonable impedance for the filter, there are several ways to design the filter input. If the impedance happens to come out at a convenient level for the load of a preceding amplifier, the first resonator is returned not to ground (as are all others) but to B+. The high side of the input is connected to the plate of the tube. A word of caution here: The dc component of the plate signal will tend to alter the inductance of the toroid slightly, and this type of filter will have to be tuned while being driven by and driving the circuits in which it is to go. Another method is to determine the required impedance and the turns ratio which will give same when a link is wound on the first (input) coil. The method used to find the natural input impedance of the filter from other parameters will be shown.

The output of load impedance for all cases of the filters described here is, ideally, infinite. Practically, it is very high making it quite suitable to feed the grid of a following amplifier stage. If it is necessary to feed a low or medium impedance with these filters, a cathode follower can be designed which will have the correct output impedance and very high input impedance. Data for this will be found in *Reference Data for Radio Engineers*, ITT, fourth edition.

The ITT handbook is a necessary item when using this design procedure because it contains the basic information for the design parameters. Reference to page and figure numbers are from the handbook unless otherwise specified.

This procedure and configuration holds *only* for the narrow bandwidth case. The

design rests on the assumption that the coupling capacitors' reactance remains constant throughout the passband. It can be seen that this will be approximated only in narrow band filters. There is little call for filters that are very wide in a RTTY demodulator, so little difficulty will be experienced in this area.

In summation, these filters will be narrow-band, capacitvely coupled resonators, linear phase response, loaded only at the input (singly loaded).

Definition of Design Parameters

The first step in designing the filter is to define the parameters and characteristics which the designer wishes his filter to possess. The characteristics of the elements to be used must also be stated.

1. Center frequency = f_O – the frequency to be passed with least attenuation.
2. Bandwidth = BW – the range of frequencies passed with 3 dB or less attenuation.
3. Number of sections desired in the filter. Five sections are suggested, because with less, the skirts are not steep enough for use as closely spaced channel frequencies without some cross-channel interference. Seven sections are rather elaborate, but there may be applications where the additional skirt steepness is necessary.
4. Circuit "Q" (QC) = f_O/BW.
5. Available element ' Q" = QB. For the 88 mH toroids, since the dc resistance is on the order of 8 Ω, the QB is given by QB = $(2\pi)(f_O)(0.088)/(8)$, or, more simply, $(0.691)(f_O)$.
6. QP = (QB)/QC).

Now that the basic parameters have been defined, the design can begin. On pages 203 and 204 in the ITT Handbook, find the attentuation curves for the filter with the number of sections that you have chosen to use. Be sure the attenuation meets your needs. On pages 223 and 227 find the design curves for the three section and five section filters. Figure 37 (page 227) shows the general configuration of the filter.

Actual Design Procedure

Using the graphs in the handbook applying to the number of sections chosen, we proceed:

1. Chose the ordinate (horizontal axis) equal to "QP."
2. From the abcissa (vertical axis) read off all "k" values and that of ' q1."
3. A low pass prototype will now be computed (p. 164, Fig. 1c). The "P" values so derived will be the elements of a pi-section low pass filter with a cutoff at 1 rad./sec. and an input impedance of 1Ω.

The formulas are:

P1 = q1
P2 = 1/((k12)(k12)(P1))
P3 = 1/((k23)(k23)(P2))
etc.

4. The prototype will now be scaled to a cutoff frequency consistent with the bandwidth chosen. This requires that all element values be multiplied by "QC." They will be called the "A" values:

A1 = (P1)(QC)
A2 = (P2)(QC)
etc.

5. The normalized values for the resonator capacitors and the input impedance is now found. The resonator capacitors are set equal to A1. Since the filter is to resonate at 1 rad./sec., the inductance is given by 1/A1. These are "L" and "C'." Since we will use only the 88 mH inductors, the input impedance must be chosen so that the final value of the inductance is 88 mH. It is given by:

$Z = (2\pi)(f_O)(0.088)/L'$

6. A scaling factor will now be found which will render the final capacitance values of the filter from those "prime" values given above and further on in the procedure:

$S = 1/((2\pi)(f_O)(Z))$

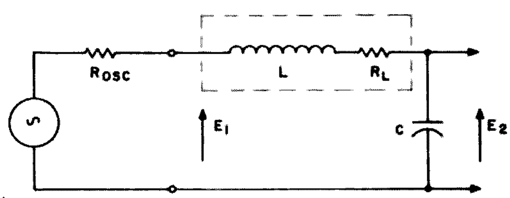


Fig. 1. Determination of QL.

To check your work, find the final value of C (C = (C')(S)). Check your result for resonance with 88 mH at the center frequency by means of a reactance chart or the resonance formula.

7. The coupling capacitors are now determined. The designation "C12" will mean the coupling capacitor between sections 1 and 2 of the filter. (See Fig. 37, p. 227).

$$C12 = \sqrt{\frac{(C')}{(A1)}\frac{(C')}{(A2)}}$$

$$C23 = \sqrt{\frac{(C')}{(A2)}\frac{(C')}{(A3)}}$$

8. The normalized coupling capacitors should now be multiplied by "S" to get the final values.

Final Notes

The design is now complete. There are several things to watch out for, however. The "QP" value used on the horizontal axis of the design graph should be taken about 5% low to account for core losses, etc. Further, if the design frequency gets higher than about 3 kHz, the core losses in the 88 mH toroid begin to rise and the "QB" drops off. This should be taken into account. The best way to get the "QB" of the coil at the design frequency is to measure it directly. The figure shows how this can easily be done with a good VTVM and an audio generator. This measured "QB" should then be used to compute "QP" and the design will be exact. Where the "QB" is in question, this procedure must be employed to obtain an exact "QP."

Tuning the Filter

Tuning these filters is quite simple. The most important requisite is an accurate frequency source at the center frequency. This can be set by Lissajous figures, frequency counters, etc. Each resonator in turn, from input to output, is fed through a high resistance from the generator. All other coils in the filter are shorted out. The resonator which is active is then tuned for a peak at the center frequency. This procedure is repeated for each resonator, in turn, from input to output. The easiest method for tuning the resonators is to start with a C value about 10% below the design value. The VTVM is then hooked across the resonator and the generator set at the center frequency *accurately*. A capacitance decade box is connected across the resonator and the capacitance needed to peak the VTVM at the center frequency is simply dialed up. The decade is then removed and a fixed capacitor (or combination of capacitors giving the exact decade reading) is placed across the inductor. The resonator is then checked again for a peak exactly at the center frequency. There is no reason that accuracy to 1 Hertz cannot be achieved by calibrating the generator with the 60 Hz line frequency and reference frequencies of WWV, using Lissajous patterns. Of course, use of a frequency counter is most convenient.

Mechanical Details

Care should be taken in the final assembly of these units. The filter should be tuned in a "breadboard' configuration, but connected to the circuit in which it will be used. When the filter is tuned, the individual L-C pairs (resonators) should be numbered to keep them in the proper sequence. This is important because the values of the coupling capacitors on either side affect the resonance point of each L-C circuit. These resonators cannot be mixed up or the filter will be badly out of tune.

The capacitors should be 5% units, MYLAR, for stability. Other types of capacitors (paper, disc ceramic, etc.) should not be used if a high quality, stable unit is desired.

Wrap the input toroid if a link is to be wound upon it. It should be wrapped with mylar tape to avoid the possibility of scuffing the insulation on either the main winding or the link when the link is wound. Winding the link is an easy procedure if a shuttle is employed. This can be any type of rod or stick with notches cut in either end. The wire is then wound on the shuttle end-to-end (around the ends) until the required amount for the link is on the shuttle. The shuttle is passed through the center and around the outside until the required number of turns are completed. The wire is dispensed from the shuttle as needed. Use a wire size sufficient to carry the plate current.

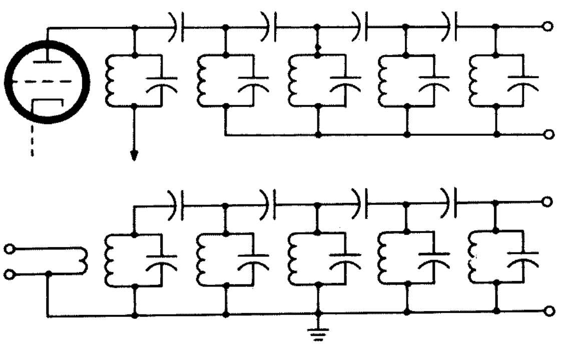


Fig. 2. Typical 5-section filters.

Take care on final assembly that the toroids are not completely surrounded by metal. This is equivalent to a shorted turn, and the filter will not operate.

The inductors may be placed one on top of the other without fear of mutual coupling, if a cardboard disc the diameter of the toroid is placed between each coil.

Parts layout for the filter is not critical if the above rules are heeded. I managed to pack two 5-section filters into a 2¾ x 3¾ x 2¼ in. deep drawn can. The filters were assembled in a vertical fashion and wired without terminals. They were placed inside the can, and the leads brought out. The can was then filled with RTV-11 room temperature vulcanizing rubber.

Epoxy should be avoided because in quantities sufficient to fill the aforementioned can, the temperature rise caused by curing will change the element values and the result is a hard block full of worthless junk!

A form-fitting top was punched for an octal plug, which was installed and sealed with a bead of epoxy. The top was then fitted to the can, the leads soldered to the pins, and the top soldered to form a hermetic seal. This type of construction makes the filter well protected against damage, moisture, and other possible enemies.

Summary

The ability to design his own filter is a great asset to the RTTY man. He can tailor the channel bandwidth to his own needs; wide for net or round-table use or for the guy who hasn't taken the time to set his shift accurately; narrow (to 66 Hz) for digging into the noise for weak signals and for crystal controlled auto-start monitoring. Narrow filters, while giving excellent signal to noise ratio, have several disadvantages. Tuning to the center of a set of 85 Hz filter is critical and difficult, especially if the TU has no tuning indicator (i.e., a scope). Also, using the narrow filters at high frequencies requires a greater QC, resulting in more ring. There is a point, yet to be determined, where the gain in S/N is overpowered by the ringing tendency on noise. Choice of shift, center frequency, channel bandwidth, and channel skirt selectivity are powerful tools for the RTTY enthusiast interested in improving his receiving copy. The ultimate, short of mixing in the channels and using identical channel filters, is to have several sets of filters giving selectable shift and bandwidth capability. A great improvement in copy is obtainable (approximately 6 dB better S/N) by going to 85 Hz channel bandwidth from the usual shallow-skirted, 300 Hz single-toroid filters found in many TU's. When designing filter pairs for two-tone of FM use, the area under the response curve of each of the filters should be made as nearly equal as possible. This will ensure equal noise energy in each channel and provide optimum cancellation of noise.

To determine the response curve of a filter design without actually building it, refer to the response curves on pages 203 and 204 of the handbook. Knowing that the two frequencies of equal attenuation give the center frequency as their *geometrical* mean, one can draw the response curves scaled logarithmically from those given. The bandwidths of the filters of a pair can be adjusted around optimum to give equal areas under the response curves. The area should be taken with a bottom limit of −60 dB.

The design lists a resistor to load the input resonator. In practice, this is adequately accomplished by loading the input slightly heavier than design.

. . .WB6NWQ

References

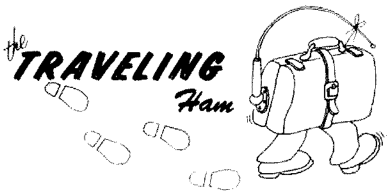
1. *Reference Data for Radio Engineers* IT&T, Fourth Edition.
2. *Simplified Modern Filter Design,* Philip R. Geffe (Rider, 1963).
3. *Of RTTY – and Filters,* Frank VanBrunt W3TUZ, 73 Nov. 1962.

of the best all around coverage of any machine out here, and TDD is starting to develop into another SUR as far as getting late night QSO's are concerned. TDD is located atop Mt. Wilson at about 6700 feet msl. Needless to say, it's coverage is near fantastic. I myself have heard mobiles in San Diego quiet the machine.

Now I don't mean to slight any of the other repeaters in this area. It's only that I have not had the opportunity to use most of them as yet. So that's it for now . . . please let me know what you think of Looking West. Feedback both positive and negative is necessary if Looking West is to continue.

WA2HVK/6

Editor's note: Bill is an old, old friend of 73, and we're glad to hear from him. We've been trying for a couple of years to get someone to provide FM news from those west of the San Andreas Fault before it breaks off and drifts up to Alaska, so we welcome Bill and his effort. If you like this material, let us know and it'll continue.



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Silver Spring MD 20910

This month we look at the scene down under in Australia and New Zealand. For local use, there are plenty of VHF repeaters covering the big cities. They even have a class of license similar to the American Technician class, so reciprocal permits are available to all. They use nationally agreed channels just like the U.S.

The following frequencies are in use in Australia:

FM SIMPLEX
145.854
146.000
146.146

FM REPEATERS

Input	Output
146.100	145.600
146.400	145.900

Deviation ±15 kHz

The following frequencies are in use in New Zealand:

FM SIMPLEX
Every 50 kHz between 145.80 and 146.20

FM REPEATERS

Channel	Input	Output
A	146.30	145.60
B	146.35	145.65
C	146.40	145.70
D	146.45	145.75

Deviation ±12 kHz

I don't have any very recent information on the locations of the Australian repeaters, but the following list covers New Zealand:

CHANNEL	LOCATION
C	North Auckland
B	Whangarei
A	Auckland
B	Waikato
C	Eastern Bay of Plenty
A	Northern Hawkes Bay/ Gisborne
C	Southern Hawkes Bay
D	Taupo
C	Egmont
B	Wairarapa
A	Hutt Valley
D	Wellington
A	Farewell Spit
B	Takaka
A	Nelson
B	Westport
C	Greymouth
B	Hokitika
A	Christchurch
B	Timaru
A	Dunedin
C	Central Otago
B	Invercargill

This list is reprinted from the 1972 New Zealand Call Book.

All repeaters are carrier access in both countries. Thus for anyone visiting those places a useful simplex channel would be 146.000 MHz.

If you do not monitor VHF but would like to work or monitor the HF bands, remember that the 40 and 80 meter bands will be smaller than in the USA and that both countries have an 11 meter band. You may even get some QSO's on a CB rig.

For the most up-to-date information on reciprocal licenses, write to the national societies. They will also be able to give you club addresses and phone numbers in the places you hope to visit.

Their addresses are as follows:

New Zealand Association of Radio Transmitters Inc. (NZART)
Box 1459
Christchurch
New Zealand
Telephone: Christchurch 64556

Wireless Institute of Australia
Try writing to the Victorian Division. They publish the magazine, and should have the most up-to-date information.
Victorian Division WIA.
478 Victoria Parade
East Melbourne
Victoria, 3002
Australia
Telephone: 413535

G3ZCZ/W3

FCC NEWS

The following was released by the FCC concerning its action on repeater petitions that were filed against Docket 18803, Rules and Regulations governing repeater installations. While the decision was reported in brief last month (p. 24), here is the actual Opinion and Order *that was adopted by the FCC on December 20, 1972.*

In the Matter of Amendment of Part 97 of the Commission's Rules concerning the licensing and operation of Repeater stations in the Amateur Radio Service –

MEMORANDUM OPINION
AND ORDER, FCC 72-1184
89733

1. The Commission has under consideration its Report and Order (FCC 72-757) released September 8, 1972, in the above-entitled proceeding, the petitions for reconsideration, and/or stay, and other petitions requesting changes to the rules adopted in the Report and Order, filed by The Northern Berkshire Amateur Radio Club, Inc.; Wayne Green (2 petitions)[1] 73 Magazine for Radio Amateurs (4 petitions)[1]; The Texas VHF-FM Society; The Fort Worth Chapter of the Texas VHF-FM Society; Fort Worth-Tarrant County Office of Civil Defense; Fort Worth-Tarrant County RACES; North Central Texas Six-Meter Repeater Association; Repeater Committee of the Arlington (Texas) Radio Club; VHF Advisory Committee of Montana; The Engineers Repeater Group; American Radio Relay League (ARRL); Naval Communications Command; Ben F. Meyers, Jr.;

Michael F. Troy, et al; James L. Hudson; Roy L. Albright; Robert S. Levy; P. Mieir; H. L. Watkins; and the Northeast Repeater Association. In addition to these petitions, which were timely filed, there were a number of informal letters and petitions received by the Commission after the time for filing petitions for reconsideration had expired,[2] both in support and in opposition to the amendments to Part 97 as adopted in the Report and Order.

2. Briefly summarized, the petitioners request reconsideration of the Report and Order, and seek either additions, deletions, modifications or a combination of these to the amendments adopted therein, or a stay in the date the amendments become effective. The petition of the Northeast Repeater Association, requests neither a petition for reconsideration nor a petition for review, but merely requests an extension of 30 days in which to file a petition for reconsideration.[2]

3. The majority of the petitions address the matter of supervisory control of a repeater station, and the nature of the responsibility of a repeater station control operator. Indeed, from the remarks of the petitioners, it appears some misunderstanding existed about the need for a control operator under the rules in force prior to the adoption of Report and Order 18803. Then, as now, when in operation every amateur radio station must have a control operator at an authorized control point. Unattended operation of an amateur radio station is not provided for in the rules. The petition of the Fort Worth-Tarrant County Office of Civil Defense, requests amended rules to permit repeater stations to operate without a control operator on duty. Petitioner Albright requests additional rules for special unattended repeater stations equipped for tone-coded access on the input frequency. Petitioner Hudson requests another class of repeater station be established in order to accomplish the same purpose. The Engineers Repeater Group petition requests tone-coded access be a requirement for all repeater stations, and the user-operator transmitting the access signal be made responsible for the proper use of the repeater station. The Texas VHF-FM Society petition requests tone-coded access be permitted as an alternative to continuous monitoring.

4. Seven petitioners request that the rules place the burden for proper use of repeater station only upon the user station operator transmitting on the input frequency of the repeater station. They further request that the rules limit the responsibility of a repeater station control operator to properly maintaining the technical operation of the station. Of these petitions, several would require the control operator to have the means to remove the repeater station from service upon notification that the station was being used improperly. Although not specified, the notification would presumably come from user operators. Petitions would allow 15 minutes or more after the notification for the control operator to terminate the repeater station transmissions.

5. Seven petitions request rules for repeater stations having wide regional coverage. The petitions request deletions of the provisions of §97.89(c) and §97.69(c) which effectively limit the service area of repeater stations to intra-community coverage. Some of these also request an increase in the maximum authorized power limits for repeater stations, in one or more amateur frequency bands.

6. The Fort Worth-Tarrant County Office of Civil Defense petition requests, in effect, that repeater stations in RACES be permitted to operate in the entire 220–225 MHz frequency band. Petitioner Harris requests the same provisions and would also allow RACES repeater stations operating on frequency bands 50.35–50.75 MHz and 145.17–145.71 MHz to also be used for non-RACES purposes. A 73 Magazine for Radio Amateurs petition requests the entire frequency band 220–225 MHz, and an additional 2 MHz from 440 to 442 MHz, also be made available for repeater station operation. Additionally, petitioner 73 Magazine, requests rules permitting crossbanding of repeater stations.

7. The Northern Berkshire Amateur Radio Club petition requests the deletion of the requirement for certain of the showings specified in §97.41 for repeater stations. The Repeater Committee of the Arlington Radio Club petition requests additional rules providing for temporary, experimental repeater stations.

8. The information submitted in the petitions adds nothing new to that available and considered by the Commission in adopting the Report and Order. While the Texas VHF-FM Society petition puts forth the argument that amateurs have demonstrated the means to generate stable, distortion-free, audio tones required for accurately coding and decoding control signals, through the use of a recently available, inexpensive, hybrid integrated circuit, tone stability alone was not a major consideration in the decision to confine the use of such signals on a repeater station input frequency to secondary control purposes only.

9. Operation of a repeater station in the Amateur Radio Service can present unique problems not comparable to other radio services such as Land Mobile or Citizens Class A, where control operators are not required at repeater stations. For instance, specific frequencies are not assigned to amateur radio stations, as they are in other radio services. An amateur radio station operating frequency must be selected by the control operator. Good amateur practice requires that he monitor his selected frequency prior to transmitting, in order to insure that the transmission will not interfere with radiocommunication already in progress on that frequency. Repeater stations are no more exempt from this requirement than are any other type of amateur radio station. Indeed, with over 90% of the licensed amateurs in the Country alone having access to all of the frequencies where repeater stations are permitted to operate, supervisory control is very necessary. Moreover, these frequencies are not limited to voice operation. All of the types of emissions authorized for amateurs may be used on most of the frequencies where repeater stations are also permitted to operate.

10. Good amateur practice also requires the control operator of a repeater station to monitor the input receiving frequency prior to activating the repeater transmitter. A repeater station, as with any amateur station, may not retransmit signals not intended for retransmission. Again supervisory control is necessary since there could be radiocommunication already in progress on the input frequency not intended for retransmission. Also, if a repeater station retransmitted a simplex radiocommunication between stations on the input frequency, it would be violating the rules prohibiting one-way transmissions.

11. Several petitioners recognize these problems and propose to overcome them through a tone-access system. Users would activate the repeater station by transmitting a certain combination of tones on the repeater station input communication frequency channel. Such a technique is inadequate to provide supervisory control over a remote station. It will not prevent the activation of the station by unauthorized persons, nor will it assure that the control operator can deactivate the station where there are interfering stations on the same input frequency channel. Controlling an amateur radio station by radio remote control with a control link that uses a widely-known frequency, such as the input communication channel of a repeater station, is not good amateur practice. The use of

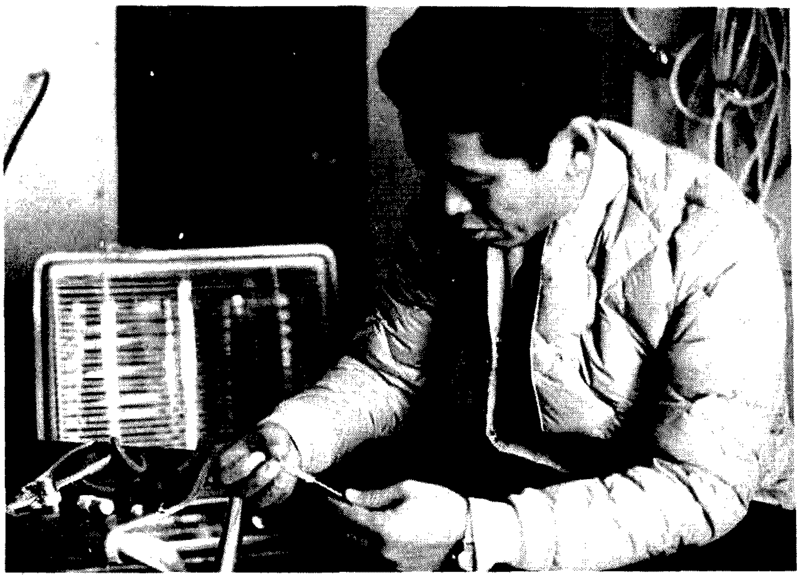
widely-known audio tones, such as those used in public telephone dialing systems, for remotely controlling an amateur radio station, is also not good amateur practice. A basic principle of radio control is that there be a reasonable probability the remote station will not be activated by unauthorized persons, and the control operator can indeed effect supervisory control of the station from the remote control point just as well as if the control point was located at the station.

12. We believe the ingenuity of amateurs can eventually develop the techniques, technical and operational, that will permit the adoption of rules for automatically controlled repeater stations. It is conceivable that automatic and reliable means can be developed that will perform all of the supervisory functions of a repeater station control operator under certain specific conditions. The Commission urged knowledgable persons to submit information on this approach. Several amateurs have already responded and although their ideas show promise, it is clear that provisions for automatic control are not warranted at this time.

13. The ARRL petition requests the effective date of the new and amended rules relating primarily to repeater stations be stayed until February 19, 1973. The Levy petition requests the rules be implemented after a minimum of ninety days. One of the Green petitions requests a delay of one year in the effective date of the amendments. The Troy petition would stay and put aside selected portions of the new rules. Inasmuch as the policy established for transition to the new rules announed in a Public Notice (90785) dated October 6, 1972, does provide a reasonable time for existing stations affected by the new rules to make the appropriate modification necessary for compliance, for the most part the objectives of the petitioners are already achieved. For instance, a station operating as a repeater station, and/or one authorized for remote control, whose license was granted as a result of an application filed prior to October 17, 1972, the effective date of the new rules, should comply with the new rules to the extent possible after that date, but must fully comply by no later than June 30, 1973. In view of the time and effort already expended in studies, evaluations and discussions in this matter, there should not be any further delay, with consequent postponement of the substantial public benefits the new rules promise.

14. The petition by the Naval Communications Command would delete military recreation stations from the types of amateur radio stations prohibited from portable or mobile operation by §97.95(a)(1). Petitioner cites three examples of portable operation by military recreation stations; K4NAA at the Armed Forces Communications and Electronics Association Annual Convention; Navy or Marine Corps sponsored military recreation /MARS station exhibit at the Southern Nevada Amateur Radio Club, Inc., Annual Convention; and the field day and emergency communications provided by K3USN. Since non-amateurs may be the license trustee of a military recreation station, they are not required to be familiar with our rules. These stations are principally intended for the recreational use of amateur radio operators serving in the Armed Forces, and the few instances where portable or mobile operation of a military recreation station is warranted can be best handled on a case-by-case basis.

15. After reconsideration of all factors raised in the several petitions, we conclude that the amendments to the Amateur Radio Service Rules as adopted by the Report and Order, FCC 72-757, on August 29, 1972, in docket 18803 are reasonable and in the public interest. Therefore, in view of the foregoing, IT IS ORDERED, that the petitions for reconsideration and/or stay listed in paragraph 1 ARE DENIED and that the amendments to



During Mr. Inoue's vist to 73 last december he became "one of the gang" as he pitched right in and helped repair the WA1KGO Repeater atop Pack Monadnock Mountain.

the Amateur Radio Service Rules, Part 97 adopted on August 29, 1972, ARE AFFIRMED

Fĕderal Communications Commission
Ben F. Waple
Secretary

1. One of the Wayne Green petitions, and the four 73 Magazine petitions were not petitions for reconsideration and/or stay. Since they do request amendments to the rules adopted in the Report and Order, they are included in this proceeding.

2. Section 405 of the Communications Act of 1934, as amended, requires petitions for reconsideration to be filed within 30 days from the date which public notice is given of the order, decision, report, or action complained of. Among the late filed petitions were those filed on behalf of the Interstate Repeater Society, the Amateur Radio Caravan Club of New Mexico, and the Trenton Radio Club. The Commission has no authority to extend the time during which petitions for reconsideration may be filed.

DAYTON

The 22nd Annual Dayton Hamvention will be held Saturday, April 28, 1973, at the Dayton Hara Arena. Technical forums, exhibits, flea market and 450 MHz transmitter hunt. For information write: Dayton Hamvention, Box 44, Dayton OH 45401.

BIRMINGHAMFEST

The BirmingHamfest Amateur Radio Convention will be held on May 5–6, 1973, at the Alabama State Fairgrounds Exhibition Hall in Birmingham AL. This event is sponsored by the Birmingham Amateur Radio Club, John A. Outland, WB4PJU, President. Those wishing to attend or exhibit can get information by writing to P.O. Box 603, Birmingham AL 35201.

MIDLAND SWAPFEST

The Midland Amateur Radio Club, Midland, Texas, will hold their annual Saint Patrick's Day Swapfest on Sunday, March 18, 1973. The Swapfest will be preceded by the usual Social Events the afternoon and evening of March 17th.

COLUMBUS HAMFEST

The Columbus Amateur Radio Club, Inc., of Columbus, Georgia, will hold the fifteenth annual hamfest here at the Fine Arts Building, behind the Municipal Auditorium, at the Fairgrounds on March 25, 1973. For further information, write to J. T. Laney K4VGI, 1905 Iris Drive, Columbus GA 31906.

BALTIMORE HAMBOREE

The Greater Baltimore Hamboree will be held at Calvert Hall College, Putty Hill and Goucher Boulevard, Towson, Maryland (one mile south of Exit 28 of Beltway-Interate 695), on Sunday, April 8, 1973 at 10 A.M. Food service, flea market, prizes. Registration: $2.00 NO table or percentage charges. INFO: Joe Lochte, 5400 Roland Ave., Baltimore MD 21210.

MUSKEGON HAMFEST

The 1973 ARRL Great Lakes Division Convention-Hamfest will be held in Muskegon, Michigan on March 23–24. Ham-Hospitality will be offered at the Ramada Inn on Friday evening the 23rd. Saturday, starting at 8:00 AM, technical sessions, swap & shop, commercial exhibitions and net meetings will be held at Muskegon Community College. More fun at the Ramada Inn that night! Tickets are $2.25. Reservations and info may be had by contacting Muskegon Area ARC, PO Box 691, Muskegon MI 49443 (see their ad on page 105). If you attend you will also be able to meet the gang from 73 . . . we'll be there!

TRI-COUNTY SWAPFEST

The Tri-County ARC Midwinter Swapfest will be held March 11, 9 A.M. to 5 P.M. at the National Guard Armory, Whitewater WI. $1. advance, $1.50 at the door (additional $1. reserves one display table). Advance tickets eligible for special prize. Talk-in on .94. Refreshments, free parking, everything indoors. For tickets and details, contact Dan Servais, WA9AJW, RR4 Box 309AA, Elkhorn WI 53121. Tel. 414-723-2227. S.A.S.E.

FORT WALTON BEACH,FLORIDA SWAPFEST

The Playground Amateur Radio Club in Fort Walton Beach, Florida, announced the 3rd Annual North Florida Swapfest, to be held on March 25, 2973, from 8 a.m. to 4 p.m. at the Community Center located on Highway 98. Talk in on 146.94, 34/76, and 3957 kHz. Tickets and details are available from the Club, P.O. Box 873, Fort Walton Beach FL 32548.

ROCK RIVER HAMFEST

The 7th annual Rock River Radio Club Hamfest will be held on Sunday, April 8, 1973 at the Lee County 4-H Center in Amboy IL. Advance ticket price is $1.50 and gate price is $2.00. Prizes – free coffee and donuts from 9–10 a.m. – indoor facilities. Talk-in will be on .94. Note: Absolutely no fire arms permitted!! Tickets are available from Carl Karlson W9ECF, Box 99, Nachusa IL 61057.

TOLEDO AUCTION

The Toledo Mobile Radio Association's 18th Annual Amateur Radio Auction is to be held on Sunday, March 4, 1973, at Lucas County Recreation Center, Maumee, Ohio. Contact Barry C. Leeper WB8EAV, Raffle Committee, 1811 Wellesley Drive, Toledo OH 43606 for further details.

LAFAYETTE ARC BANQUET

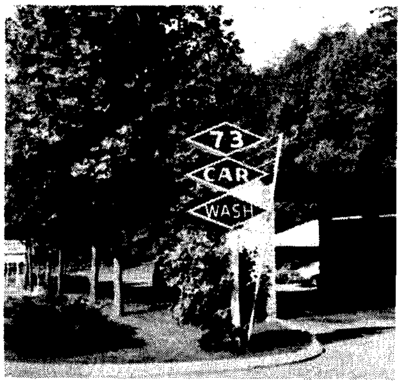
The Lafayette Amateur Radio Club, Inc., will hold the Annual LARC Banquet on Saturday, March 10, 1973, at 7:30 PM at the American Legion Home, Surry Street, Lafayette, Louisiana. Trophies for the LA QSO Party, the famous "E" awards, and the annual "Cajun Award" will be presented. The food will be a "Cajun's Delight" prepared by Marshal Dallas Broussard. Happy hour will begin at 6:30 PM. Tickets are $7.00. LARC Banquet 1973, P.O. Box 345, New Iberia LA 70560. Talk in on 94/94.

FLORIDA QSO PARTY

FLORIDA SKIP, the all Florida Amateur Radio Publication, is happy to announce the 9th annual FLORIDA QSO PARTY to be held April 7th and 8th, 1973. All amateurs are invited to participate. Florida amateurs are urged to work as many out-of-state stations as possible as well as those within the state. Contest periods: Sat., 1500–2000; Sun. 0000–0500, 1400–2359. All times GMT. Exchange: Florida stations: RST and county. Non-Florida: RST and state, province or country. Trophies will be awarded to high scoring stations. Contact FLORIDA SKIP, Contest Chairman, P.O. Box 501, Miami Springs FL 33166 for further information.

1973 IARC PROPAGATION RESEARCH CONTEST

The object of this contest is work as many CPR zones as possible. Phone dates 0001 GMT Mar 24 to 2400 GMT Apr 1. Exchange signal report plus zone number. Final score equals number of zones worked times number of contacts. Contacts in own zone do not count as contact points. Mail all logs to L. M. Rundlett, 2001 Eye St., N.W., Washington DC 20006.



Here's a view of 73's Controlled Environmental Laboratory where we can put a mobile rig through a severe conditions test far exceeding any other devised.

Peter Stark K2OAW at the FM Symposium that was held last December in New York.

HAM HELP

Occasionally 73 receives letters from aspiring amateurs wanting to know if we can locate someone to help them get their license. Perhaps there are many more of our non-ham readers who also desire help.

Starting with this issue, we will publish names, addresses and telephone numbers of those desiring assistance. If you need help, don't be bashful about sending us your name . . . you do want your license don't you?

Each month, amateurs and clubs should look the list over and give a hand to those in their area. As new names come in, previous names will be removed from the list.

Earl L. Grove
891 Commonwealth Ave
Venice CA 90291
213-396-7315

1Lt Olin L. Beall II
530-34-9383
Hq Co
USA CCD
APO San Francisco CA 96460 (South Korea)

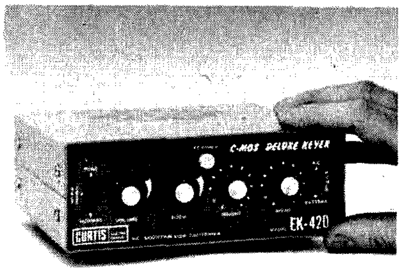
Oatley W. Wells
RFD 1
Concord NH 03301
603-746-3916

SQUEALERS NEEDED!

Anyone who has first-hand (personal) knowledge of radio violations should send specific details to the Chief, Safety and Special Radio Services Bureau, 1919 M Street N.W., Washington DC 20554; Attention: Legal, Advisory and Enforcement Division, Room 408. General information is useless; they need to know exact details such as whom, when, where, what, and why.

NEW PRODUCTS

FLEA POWERED KEYER



A super low-power electronic keyer employing complementary MOS (C-MOS) integrated circuits has been announced by Curtis Electro Devices, Inc.

The EK-420 C-MOS deluxe keyer offers self-completing dots, dashes and spaces, dot memory, iambic operation, built-in sidetone with 4" speaker, built-in power supply and reed relay for grid-block or solid state rigs. It operates on 115V ac or +4.5 to +14V dc.

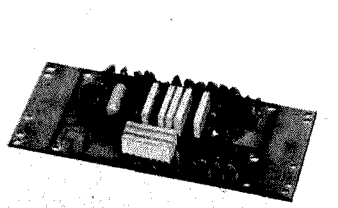
Because of C-MOS circuitry, the EK-420 consumes only ½ mW during standby. When keying, power consumption rises to 180 mW. This allows extended operation on an inexpensive snap-in transistor battery (9 volt).

A rear panel accessory socket allows instant connection of a soon-to-be-announced, four program 2,048-bit (200 character) memory unit.

Front panel controls include sidetone volume and pitch, weight and speed, tune, self-test, and ac-battery selector switch. All eight IC's, three transistors and the reed relay plug in to allow easy field service.

For more information contact *Curtis Electro Devices, Inc., Box 4090, Mountain View CA 94040.*

MOTRAC TONE KIT



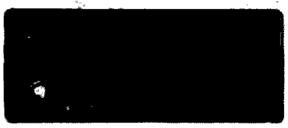
The new ALPHA SS-80J/192 subaudible tone encoder/decoder has been especially designed for use in the Motorola Motrac series of two way radios.

The SS-80J/192 utilizes thick film hybrid modules that contain all the active circuitry used for the encoding and decoding of tone. The thick film hybrid technique makes possible an exceptional degree of reliability under severe environmental extremes including high vibration and temperature from -40° to $+100^{\circ}$ C. The frequency determining modules are laser trimmed to the precise frequency required and are therefore not subject to the reliability problems of reeds and the frequency stability problems of tunable types of tone.

The unit is completely compatible with all Motorola, General Electric and RCA sub-audible tone systems and is available in standard or special frequencies from 20.0 Hz to 250.0 Hz. Provision has been made to accommodate up to six tone frequencies which may be electronically switched if required.

For additional information call or write *Alpha Electronic Services, Inc., 8431 Monroe Ave., Stanton CA 90680 (714) 821-4400.*

NEW COUNTER



Regency has announced an excellent new counter, the EC-175. This unit has six LED readouts, making it possible to read a 146 MHz frequency out to the kHz, which is extremely handy when you are tweaking a crystal on channel.

Regency has overcome one of the basic problems inherent in most inexpensive counters — the warm-up time — by letting the crystal oven run all of the time and having the front panel on-off control turn the rest of the unit on. And off. Thus the counter is all warmed up ready to go any time you need it.

There is a five position switch on the panel which moves the decimal point over, from where the last figure reads kHz, to where it reads 1/10th Hz! Thus a signal on 146.190 would be read that way in the first position. In the second it would read 46.1903, indicating that the crystal was 300 Hz high. In the third it would read 6.19037; 370 Hz high. In the fourth it would read 190.371; 371 Hz high. In the last spot you might get a reading of 90.3746; 374.6 Hz high. What you gain in accuracy you lose in time, as it takes about ten seconds to count out a tenth of a cycle reading. The MHz reading zips off as fast as you could want it, enabling you to put a crystal on channel while watching the counter without the usual wait for each count down.

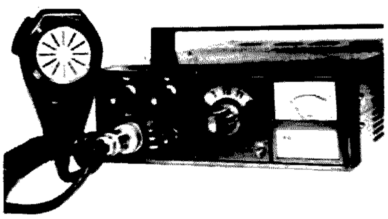
The sensitivity is a delight, too. One of the more frustrating aspects of some counters is that fiddling around to get the probe where there is exactly the right amount of rf to get a count. This can be quite difficult in putting receive crystals on channel. The EC-175 is as sensitive as any we've tried and is so hot that it can be turned up to where it will count a nearby radio station. During one test we were able to copy a nearby Novice on 15m just by watching the counter readout. The Novice was operating from the 73 Radio Club station about 100 feet away!

The unit is advertised to go to 175 MHz, but we had no problem in getting good readings at 220 MHz, so we don't know what the actual limitations are. The input impedance is 1 MΩ and sensitivity is 100 mV at 100 MHz. The time base stability (after 24 hours warm-up) is 2 parts in 10^{-8} for short term (24 hours), and 1 part in 10^{-6} for long term (6 months).

The ac supply is built in — or it may be operated from 12V dc, and it comes with a mobile mounting bracket. The unit is plenty small enough for the car, the same size as the Regency HR2 units. Price is only $449.

For further information contact *Regency Electronics, Inc., 7707 Record St., Indianapolis IN 46226.*

MIDLAND 220 RIG



Amateurs everywhere have been combing the ads and literature for the announcement of new 220 MHz gear. As was once the case with 2m FM, the lack of suitable gear has been keeping the band from really taking off. Even so, clubs around the country are starting to set up 220 repeaters and enthusiasm is growing daily.

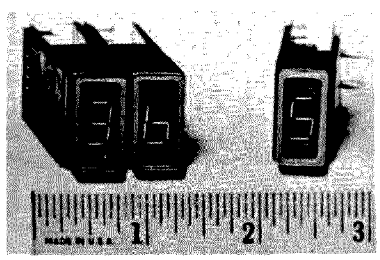
A new 12 channel transceiver has just been added to the ham market by Midland Electronics. It features a full 10 watts output with a separate power switch that reduces the level to 1 watt for short range contacts or "battery" operation with a separate pack. The receiver has an FET front end and ceramic filters in the intermediate stages for selectivity. The panel features a combination S/RF meter, 12 position channel switch, high/low power switch, volume and squelch controls and a transmit-indicator light. Inside the unit are separate trimmers for each transmit and receive crystal.

For further information contact: *Midland Electronics Co., P.O. Box 19032, Kansas City MO 64141.*

HAL ID1-A IDENTIFIER

HAL identifiers appear to be the standard of comparison. Virtually every area of the country has a repeater with a HAL CW identifier. In the past, the HAL identifiers have come as a complete circuit board for installation in a repeater. Now, however, HAL offers their ID1-A which includes its own rack panel with controls and speaker. Another great feature of the ID1-A is the ability to operate the unit from 12V dc in addition to 110V ac. This feature is particularly desirable if your repeater has provisions for operating on emergency 12V power in the event of failure of the 110 lines (which is not too uncommon at high repeater sights). Then too, the HAL ID1-A could also be used mobile. Imagine having your own CW-ID while mobile. W7DXX uses this feature while operating 2 meters aboard his Cherokee 140-D. If you are a CW operator the HAL ID1-A can be wired to sign your call at the touch of a button. Write *HAL, Box 365L, Urbana IL* for details

MINIATURE DECADE COUNTERS



Compton Electronics is offering a new line of miniature high-speed modular decade counters. The DEC-100 series of DECAPLUGS offers small size, operation from a single 5V power supply, and a unique side-by-side plug-in feature that allows fast assembly of any number of digits with no unit-to-unit wiring for main-

Continued on page 115........

........New Products continued.

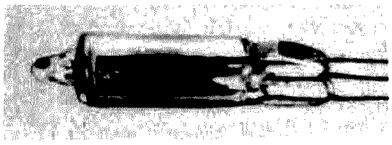
sequence operations. These devices utilize a line of miniature 7-segment incandescent readouts which are available in several optional styles. The DEC-100 up-down counter has preset capability, frequency response to 32 MHz, and mutual Vcc, gnd., load, reset, strobe, lamp test, up clock and down clock signal lines.

Full use of the 7447 decoder can be obtained from both the DEC-100 up-down and the DEC-101 up counter. This includes ripple-blanking, zero suppression, BCD output, and decimal point connections. Both units contain a latch for data strobe or data hold purposes. A variety of mounting schemes is possible, including the use of bezels with or without filters. Data lines to individual decades are connected through the use of solder pins, thus eliminating the need for special P.C. plug-in connectors for parallel entry lines.

Single unit prices for these modules are $29.50 for the DEC-100 up-down counter and $26.90 for the DEC-101 up counter, including readouts.

Contact *Compton Electronics, P.O. Box 5326, Compton CA 90224.*

TOUCH CONTROL SWITCH



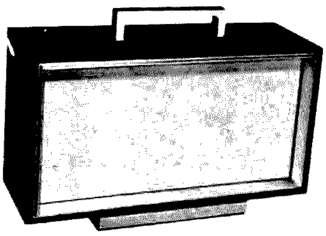
A new subminiature tube for touch control switching has been announced by Amperex. The device, designated ZA1006, is a neon-filled diode whose large and stable difference between ignition and maintaining voltages permits a highly reliable response when triggered by the body impedance of the toucher.

Touch control switching offers obvious advantages over mechanical switching. The reliability of the ZA1006 far exceeds that of mechanical selectors because it has no moving parts; operation is completely silent; switching is much faster than in mechanical devices, and switch status is self-indicating.

Ignition potential for the ZA1006 is 172 volts and its maintaining potential is only 107 volts. It draws only 3 mA of cathode current when switched on, and ignition delay is as low as 20 milliseconds. The light output is more than sufficient for reliable status indication, even in a well-lighted room.

Detailed information on the ZA1006 may be obtained by contacting *Mr. John Plump, Amperex Electronic Corporation, Hicksville Division, Hicksville NY 11802. Telephone: 516-931-6200.*

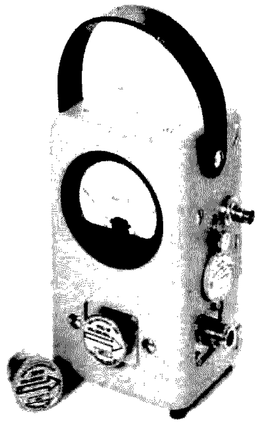
NEW CABINET LINE



Vector's new line of card cases, called Multi Mod, provides 27 basic models in a wide size range. Aluminum extrusions provide the package foundation. The dominant feature of all the cases is the four internal surfaces which have parallel grooves for positioning and holding circuit boards, mounting, or shielding plates. Circuit boards mounted in the grooves need no additional fastening devices. Due to the basic extruded design, some models provide as much as 60 dB of attenuation without special RFI gasketing.

The cases range in price from $2.40 to $10.00. Quantity discounts are available for immediate delivery. Modification of the cases to customer's specifications with special holes, panels, cutouts, etc., is offered. *Vector Electronic Company, 12460 Gladstone Ave., Sylmar CA 91342.*

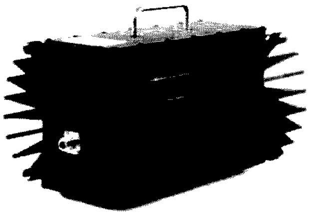
WATTMETER HAS RF SAMPLING PORT



Model 4430 is the new THRU-LINE® rf Directional Wattmeter for the measurement of forward or reflected CW power with the additional feature of an rf sampling output for frequency analysis on a scope, spectrum analyzer or frequency counter.

The wattmeter is designed for ±5% power measurement from 100 mW to 1000 watts from 2 to 200 MHz and up to 500 watts from 200 to 512 MHz, using the same standard plug-in elements in discrete bands and power levels as cataloged with the famous model 43. No plug-in elements are needed for rf analysis. The sample signal is available from a BNC output port at about 53 dB below the main signal level. The price is $145 and plug-in elements range from $32 to $75. *Bird Electronic Corp., 30303 Aurora Road, Cleveland (Solon) OH 44139.*

HALF KILOWATT DUMMY LOAD



The new Model 8431 TERMALINE® rf Load Resistor has a continuous input power rating of 500 watts in the horizontal position and 600 watts standing vertically. This high power rating is accomplished by using minimum resistance paths directly from the dissipating element on a high-conductivity ceramic substrate to a fin structure modified for optimum coupling to the free air environment. These combined design features result in a dry load smaller and much lighter than comparable liquid cooled convection loads. Specifications include low VSWR of 1.1 from dc to 1 GHz, 1.25 from 1–2.5 GHz, continuous power dissipation of 500/600 watts in ambients from –40° C to +45° C, and 50 ohms impedance. The load weighs 13 lbs. and occupies less than ½ cu. ft. Price is $250. *Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon), Ohio 44139.*

.......W2NSD/1 continued.

hobby. The rules should be written for the benefit of the amateurs who are active and with a view of helping new techniques develop. The present system used by the FCC is creaky and cumbersome, and much too prone to being controlled by one or two men in the Commission. The times when a dictator is beneficial are considerably overshadowed by those when the results are cruel – and cruel is the considered opinion which characterizes the new repeater regulations.

Obviously we need a basic change in the way rules are promulgated for the amateur service. Many years ago we had a better system – a simple one. The ARRL would decide what rules the amateurs should have and

the FCC would enact them. This worked fine as long as the League was responsible, but eventually they took advantage of their position too many times and were too arrogant about it – I remember visiting the FCC many years ago and hearing them telling about Paul Segal, the ARRL's counsel in Washington, and his bragging that he was Mr. Ham Radio and, ha ha, he didn't even have a ham license!

Perhaps, if we can figure out a way to exert ourselves with the FCC, we may eventually be able to set up a yearly or biennial convention of delegates from major ham clubs who could form committees and report in proposed rule changes for the convention to vote on – with the result being passed along to the FCC for quick action.

Such a system would seem to solve a great many of the problems that amateur radio has had with bum regulations interfering with growth. Of course it would raise some problems with the hundreds of minor FCC employees who normally spend their years until retirement initialing papers and passing them along. It is this massive pile of paperwork that adds so many years to each proposal for rule changes – a snowstorm of memos sifting slowly through the civil servants in between coffee breaks and "conferences."

In the meanwhile, a man who knows the ropes in Washington could lean on people who are slowing up things – could see that a lack of communications was not making us suffer from bad rules – could protect us from the pressures of lobbies like the EIA – could coordinate amateur clubs to provide a reservoir of good will in the eyes of congress – and be on hand when things get sticky to grease the skids in our direction.

That goodwill thing. It's been some time since I've mentioned that, but there is a lot that can be done along this line. There are 100 senators and we should go out of our way to cultivate these gentlemen. What can we do? For one thing, we can have a representative of a local ham club near their home get in touch with them and set up an appointment for them to come down and meet the club – making sure that you have the best turnout in the history of the club, no matter how many friends of friends you have to drag in. And when you pick up the senator to take him to the club, be sure that the two meter FM gear is in perfect working order and that everyone on the repeater is rehearsed to put on the best show possible. You can orchestrate this to provide several interesting chaps talking about erudite subjects – and permit the senatorial car to break in and say hello – followed by several complimentary comments on the senator – not casual ones, but comments which show a good deal of interest in him – and then perhaps a stop at a local DX magnate's shack for a "casual" (but planned) rare DX contact or two – now how did that fellow in South Africa happen to know that your senator has been extra active in ecological legislation?

The meeting should be short and devoted entirely (in every detail) to the senator. No elections. No minutes of the last meeting. No new business. Etc. Introduce your key members – explain some of the interesting and valuable things they have done (this is perhaps better than just telling him what amateur radio can do) – explain some of the problems facing us – and some of the bright spots for our future. Don't ask him to do anything for you, or for amateur radio. You are putting money in the bank for the future. You might ask if there is any way that your group can help him and volunteer to provide communications in any way that it might be helpful in the future.

The above is just a germ of an idea – and I'm sure that as soon as your club starts thinking in these terms that many more ideas will come up. Needless to say, 73 urges and pleads that you share these ideas and accomplishments which may follow with the other readers.

Try, if you do get hold of a senator or a representative, to keep from being negative. Sure your club is all bent out of shape by the repeater regulation which calls for repeaters to be monitored night and day. It does not make sense. It seems stupid and without possible reason. But don't complain about that. Point out the good things and leave the bad ones until the day when we have the strength to face the FCC and request them to make the changes we need – and can back it up with some friends. When the time comes we will tell our friends what our problems are, but right now, when there is no solution in sight, it makes it look as if we are being friendly because we want something right now. Reasonable?

And, hey, don't forget a slow scan demonstration too – his eyes will pop out when he sees television pictures coming in from a few thousand miles away. If your big gun DXer has his nose so close to the ARRL country list that he hasn't gotten into SSTV yet, dig up a set from a more progressive local and take it over to big gun and set it up there. And don't forget to set up the scheds before the big visit.

Even when we have a closer acquaintance with congress, we still need a Man in Washington to coordinate. We need someone with a good ham background – with intelligence – with some experience in politics, Washington, or at least in persuasion. And we need some way to fund this Man – and to provide him with the information he needs to perform as well as the media to communicate to all radio amateurs. A column in 73 might be the answer to this since there is no censorship of the material that goes into 73.

If anyone has any good suggestions for providing a fund to keep a Man going, this is as good a time as any to put them to paper and send them in. He could get by on $25,000, but I would think that his job would be a whole lot easier, particularly at first, if there was enough money to rent a small office, hire a part time secretary, and pay a hefty phone bill.

Of course it is a whole lot easier to shrug off the problems and make do as best we can. After all, things are moving, even if slowly. The Novices did get some space on ten meters – which may not be all that valuable right now when the band is dead most of the time, but which eventually will be fun. And the Commission did permit vfo's, right? Well, not to take too much away from the FCC, they had already permitted vxo's, and the difference is pretty slight, so they were in a bind any way you look at it. The fact is that the Novice had a simple variable frequency system which had been okayed and which freed him from the tyranny of crystal control. By the way, in case you missed it, I was quite involved in getting that one through the FCC – and it was strongly opposed by the ARRL.

Repeater groups have a lot more to gripe about and a lot more reason to be up in arms about legislation. The recent docket set up rules so restrictive that, if they are observed to the letter, repeater service will be just about washed up. At a time when we have a need for a couple thousand more repeaters, we find that most of those that are presently active will have to cut back on their service drastically, if they are to be "legal."

Few phone ops are in any way satisfied with the miniscule expansion of the phone bands which the recent regs opened up. There is no indication that the thinking at the FCC is relevant – and, if you'll remember, it was a lack of relevance which helped to trigger off some of the student rebellions of recent years.

Sure we can live with the regulations. We can live with almost anything. We can even take up some other

hobby and the FCC can go jump in the lake. But perhaps there are some of us who have a feeling of responsibility, not only to our own interests, but to our *country – and to* the world. Amateur radio has a lot to offer and it needs devoted amateurs to keep pushing against the negative forces.

Perhaps I should publish more of the extremely negative letters I get – and my answers. I feel that strong negativeness is a psychological problem and I feel sorry for the fellows who write such letters – feel sorry for their families – for after all, I have to live with the person for the time it takes me to read and answer the letter and they have to live with him every day of the year – and there is no reason that he won't have the same attitude toward his family, neighbors and fellow workers as he does some ham problem.

On the other hand, for every negative bummer there are several amateurs who are enthusiastic about things – who want to help push us ahead. They may have legitimate criticism of ideas, but they usually follow it up with constructive suggestions, which are in the end of value. You'll probably find the same people in your club as I find arriving in the mail . . . some positive, some negative – and most apathetic. Though I don't know any good way to fight negativeness, apathy can be fought with ideas and enthusiasm.

How do we go about getting a lobby in Washington? We need ideas. We need constructive suggestions. Since the ARRL route seems to be a dead end, we need to come up with other methods. Perhaps we need some sort of association set up for this main purpose – an association to which clubs could join as regional branches. This has worked well in other fields. Let's have some input.

MISSING THE FUN?

It seems a real shame that so many FMers are missing the real fun of the hobby: keeping a repeater going.

Sure it's fun to break in and talk through repeaters – it's fun to keep in touch with a few cronies on one particular channel. But all this fun fades into insignificance when you undertake to put in your own repeater.

Take the Somerville (Mass.) group that runs WA1MHN on 07–67. They've been in the repeater biz for a while and decided they wanted to add a 450 repeater to the setup. Chuck Martin WA1KPS (of A&W Electronics) is one of the driving forces in this group, plus Joe WA1PQE, Dick K1KSZ, George K1MON and several others.

They decided, after looking over the topography, that the WA1KGO spot in Peterborough NH was one of the most likely places to put their repeater. It is high and makes it possible to put a good signal down all over Boston about 60 miles away. The 73 Radio Club enthusiastically endorsed the project and volunteered the space for the setup in the KGO repeater site building.

Since the mountain is covered with ice and snow for about one third of the year, Chuck invested in a pair of Ski-doo's, with trailer and caboose. Snowmobiles do well on snow, turning over now and then, but getting there. On ice they are something else. And ice is what it is a lot of the time.

The group would drive up from Boston, struggle the Ski-doo's from the 73 barn, manage to drag the trailer to the entrance to the mountain about four miles away, then have one hell of a time getting over the ice to the top. Once arrived, with only a few overturns on the way, the ice has to be chipped from the door to the building so they can get in. Someone has to climb the 50 foot tower and break the one foot of ice off the antennas that has accumulated. Funny how the antennas lose most of their zip when they are solid ice – it must affect the tuning seriously.

About the time the frostbitten tower volunteer staggers into the building seeking warmth, he trips over the heater power cord, shorting out the 200 amp 220 volt fuse – beautiful fireworks. It's pouring rain about now – did the flashlight fall out of the snowmobile when it turned over? The rain freezes solid wherever it hits. Soon the flashlight is found – tools are found to fix the flashlight – the fuse is then repaired and the heater haywired into the line again – and work can finally start on the identifier and other projects, the original cause for the trip.

Just before returning down the mountain the ice is broken off the antennas again – the KGO 2m antenna has folded in half with the ice load, but still seems to work fairly well even so. Neither of the snowmobiles will start. Once the carburetors have been cleaned they are workable, if balky. Everything is soaking wet and frozen. The trails are glassy ice and the snowmobile is designed for snow, not ice – so they glide all over the place, going dangerously near the steep sides of the mountain a lot more times than is comfortable. About half way down one runs out of gas.

You see what I mean by fun?

One of the two snowmobiles have finally been coaxed back down the mountain there is the job of getting them on the trailer again – naturally they slide back off every time you drive them on – and when you drive a little too fast they shoot on over the end and land between the trailer and the car, with the driver pinned between.

How can you bear to pass up fun like this? Give some serious thought to getting involved with repeater installation and maintenance.

MINIATURE REPEATERS

With more and more VHF modules coming available such as the International Signal and VHF Engineering units, we have the makings of small repeaters. The fact is that all that is needed in many communities is a very small and simple repeater – 100 milliwatts is quite adequate, if it is well placed. We'd like to see articles on putting small repeaters together – on using them – on control and identification circuits—antennas.

We need small repeaters to help out at hamfests and conventions, both for communications of the organizers and the visitors. We need emergency repeaters that can be set up for temporary traffic handling. We need repeaters for smaller towns and for small areas of bigger towns. There is no reason why a repeater in a small section of Brooklyn has to be available for all of New York – or why the amateurs in and around Malden (Mass.) can't have a little local machine. When they want to talk further they will use another channel.

We need information on setting up these small repeaters. With the International signal transmitter and receiver units, how much separation is needed between the units if they are set up with 600 kHz split? How much for one meg split? What differences does it make in the amount of antenna separation? Let's have some data on all this.

IMPROVEMENTS TO 73?

While most of the 73 staff is spent busily working its way through the woods of publication, now and then we do try and step back as far as possible and look objectively at the magazine and come up with ideas for changes and improvements. The probability is that we are too close to the whole thing to have any perspective.

The fact is that ideas are not just welcome, but are solicited. We have in mind constructive ideas, rather than letters telling us how terrible the magazine is. What do you think about the developing newspages? Should we spend more time on them or less? They take up a fantastic amount ot time to get ready compared to the articles and ads, but if they are

making amateur radio more fun, then they are worth the time and space they take.

The measuring stick should be just that: more fun. In general, the more you know about something, the more fun you can have with it. Thus we try to cover as much of the hobby as we can. It may appear that we are going overboard on new aspects of amateur radio – but keep in mind that there is tremendous resistance to new things and without this pressure, many amateurs would never be moved to try the new phase.

FM and repeaters were around for several years, almost ignored by the ham magazines – and growth was insignificant. Once 73 was able to get articles on FM into print in quantity, everything changed and enormous growth was experienced. A lot of readers resisted FM – hated seeing all those articles – many still are resisting and hating. But FM is fun and as such as worth the promition and extra effort.

There are many other areas of fun that need developing – slow scan television has just scratched the surface – QRP is a ball and needs a lot of push – and it just may be possible that facsimile is around the corner! If you are one of those people who are pushing ahead instead of trying to hold everyone else back, it is possible that you have found an area of fun that needs to be written about. Do it.

Back to 73 again – and ideas you may have for improvement. Should we have more short columns on special interests? Fewer? Longer columns? More news? More editorials by people who are into new things? Too wild? Too tame? And the articles – do you like the idea of more book-length sections? Should we have more of the longer and esoteric construction projects that have been appearing in Ham Radio? Our practice has been to bypass these, but if this is wanted, so be it. Generally we try and make at least 90% of the magazine understandable to the average amateur, and hold the really high level engineering stuff to a minimum. Perhaps you've noticed that if there is any way to keep calculus out of articles, we go that route.

If there is something you don't like much, let us know, but don't forget to tell us what you'd rather have in its place. Remember that 73 is a magazine written 95% by the readers, not by a bunch of stuffed shirts who are insulated from the hobby. The editors and publisher are active in all aspects of amateur radio.

BALLOONS

Longer ago than I like to think, back when I was editing another better unnamed magazine, I remember hearing from some amatueurs who had gotten involved with ballooning. Two meters and all that.

An article in a recent National Observer stirred the memories of some of the stories these chaps had to tell and I got to wondering if any amateurs are involved with ballooning today? I've done a lot of different "mobile" two meter work, but I haven't heard of anything like this.

Somehow I suspect that a lot of readers would be interested in hearing about this. If any readers are involved with ballooning, how about telling us about it?

And speaking of mobile operation – it would be nice to get pictures of as many different types as possible – they could make the newspages. I've snowmobiled, skimobiled, horsemobiled, footmobiled, bedmobiled and swivelchairmobiled – how about you?

LIGHT CONVERSATION

How can it be that when there are so many thousands of interesting things to talk about, that the average ham contact is a bone-dry bore?

The problem is, of course, how to get into interesting areas of conversation – and this is difficult. Most of us need to consciously think about this and try to work out ways of getting conversations started.

You can't just say hello and ask if the fellow you are working knows that the spending of our lives under artificial light is having some profound effects that are not generally recognized. They have some new lamps which have the same spectra as the sun and the results they are having in experiments with these are fantastic – better teeth – better intelligence in children – offices work smoother – better health in general – and so forth (my dentist, a 73 subscriber, lent me a report on the subject). A report like this is good for dozens of contacts, if you can figure how to get it into the conversation.

And how do you come across interesting reports like that? You achieve a reputation for being interested in new ideas – you talk about new and different things over the air – and the first thing you know, your acquaintances will start noticing things that might be of interest to you – maybe sending you clippings. They might even start reading about such items themselves and thus make their contacts more interesting.

If you'd like more information on the sun spectra lights, drop a note to Duro-Test Corporation, North Bergen NJ.

More to Talk About

Another book which is chock full of incredible new ideas and which, if you can figure out how to get things like this into your conversations, should keep you going for weeks – or longer. Of course you may get a reputation as a nut for believing in such things, no matter how well researched they are, for they are mostly alien to the current beliefs of American scientists. This book is called *"Psychic Discoveries Behind the Iron Curtain."* Bantam paperback 05681, it is a fat one and sells for $1.25. If this doesn't get your interest up, you have a problem.

If you run across someone who doesn't believe in hypnotism or telepathy you can have a field day telling him about the carefully controlled scientific experiments in Russia where people were hypnotized by teleoathy – complete with eeg monitoring of both senders and receivers. Is it possible to put someone to sleep and wake him ten times in a row from a thousand miles away – all on cue? Read.

Another interesting new book, if you like things of this nature, has to do with how to avoid pains in the body. Many of us suffer from time to time from back pains, headaches, and such. The book, *"Orthotherapy"* by Michele (M.D.), $1.25 Dell 6718 just might make a world of difference. It sure would have helped my life if this book had been available many years ago – even for my parents. In a couple of days you could become the voice of expertise on how to get rid of body pains.

Have you read anything which might help us be armed for interesting contacts?

PSYCHO-LEARNING

One of the recent developments behind the Iron Curtain is the experiments in what is called psycho-learning. These techniques have been developed primarily in the area of language teaching, but they would seem to be equally applicable teaching amateur radio theory.

Without going into long details on the hows and whys of the system, I'll just give the basics of how you go avout applying the idea. I'd like to have some radio clubs give this a big try and see how well it works for them so we can report on it.

The experiments in Yugoslavia with language classes have been fan-

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tastic – and people have been learning languages at a speed never thought possible before. This has been particularly true in the case of getting large vocabularies into the memory – the toughest part of learning languages. Just think how great this would be for electronic theory!

But, down to the nitty gritty. You will need some soft lounging chairs where the people can sit back and relax completely, feet up and totally at ease. You'll need a good hi-fi system to provide background music to help relaxation and permit the mind to kind of free wheel. Then you'll want a tape system or a public address system for reading the theory course to them. The 73 study course should be ideal for this, by the way. The sessions can go a half hour or so and there is no need to do anything but just sit back and relax and let the music open up the mind while the theory goes in – and then, as if by magic, the theory will all be there when you need it. This is sort of like sleep learning, except that it works.

Give this sytem a try, if you please, and let us know what results you get. The Yugoslavs have been learning languages in weeks that would normally take months, so it would appear to be a legitimate system.

NEEDED ARTICLE?

How about an article on a little unit that will fit in the car to hold a hand transceiver – charge it – and use it as a mobile rig, complete with an amplifier? This should be a snap with the TR-22 – easy with the SR-C146A and not too difficult even with the KP-202 and the FMP.

ONE MEG

At the recent FM Symposium in Medford (Mass.) a chap speaking for the semi-defunct Northeast Repeater Association tried to stop all discussion of a one megahertz split for repeaters.

My feeling was that if the idea has no merit, then a discussion of it will kill it. If the idea does have sufficient merit, then talking about it will spread the idea – but that censorship and trying to shut people up and prevent them from talking about it is the worst way to go. The Association tried the same stunt at the Symposium in New York in Dcember.

There are many technical reasons why one meg is a good scheme – there are reasons why we should stick with 600 kHz. This is not the place to try and cover the subject, only a spot to talk about discussing it.

George K1TKJ, the chief op of WA2SUR, New York's busiest repeater, has announced that he will be putting WA1KGK back on the air soon in southern Connecticut – and it will be on a one meg split with the input on 147.49 and the output on 146.49. George is as knowledgeable as they come and few repeater groups are able to listen to his arguments in favor of one meg without starting to think seriously of making the change, even though they may have just recently made the 600 kHz decision.

Watch for a surprise announcement soon that WA2SUR will be going one meg! The plan is to put the input on 147.73 and leave the output on 146.73. This will open up the 146.13 input channel if any group wants to set it up with a 147.13 output.

As I see the situation – without any discussion of the merits and problems of one meg, we can look forward to repeaters going this route anyway. The standard channels in the 146 and 147 meg segments of the band are rapidly filling up in urban centers – and this will leave the six simplex 146 channels and the six 147 channels as the only spaces for further development. At present only about one or two of those channels has actually gotten used for simplex, so in essence the othes are open for repeaters and, as you know, nature (and repeater groups) abhors a vacuum.

This would have us end up with 600 kHz repeaters in the present repeater segments and one meg repeaters in the simplex channels. Do we want to go this route or is it time to bring the facts out in the open and discuss them so we can try to have orderly development?

QRRR?

During a recent visit to New York for a round of Christmas shopping, some movies, and such, I wore out a good deal of shoe leather hiking from one part of Manhattan to another. I also kept my batteries down by either talking or listening quite a bit to WA2SUR with my SR-C146 hand unit.

A little hand unit gives one a sense of confidence when walking around New York. It's been over ten years since I pulled up stakes after living there off and on for 30 years, and my folks for over 60 years, and I find that visiting "home" is a lot different today than it used to be. New Yorkers joke a lot about being mugged – I guess that's the only way they can live with the situation – but the fact is that ten years ago I could walk just about anywhere in New York and never give it a moment's thought. Oh, I had the common sense to stay out of Central Park at night, but I never worried about the streets or subways.

Now I find that I worry a bit. If I am going down a long block at night and the only people around are a group of several tough looking boys, I think about it. It is at times like these that a hand unit gives courage. For that matter, after thinking about it, I suspect that a unit on a belt would discourage mugging since about the only people who wear them are police.

The things that I heard during my moments of listening over a period of two days makes me wonder. Perhaps I am a lot more tuned to what is news than most FMers, but several of the things that went through SUR came under the heading of news – and it is a shame that someone with a little time in Gotham doesn't take notes on these things and send them in to 73. Amateur radio needs all the PR it can get and there is a lot of it going down the Hudson Tubes.

It is a matter of interest perhaps to record that I had a nice contact with WB2UEZ aboard the Staten Island Ferry, with me footing it across 57th Street. Then, as I reached 62nd Street and Lex, it happened – an emergency! I listened while a report came through from WA2YJZ that a car had broken down on the Brooklyn Belt Parkway and was blocking traffic. There was a long pause. YJZ asked again if there was anyone on channel to call the police. Silence.

I noticed a phone booth on the corner opposite me, so I volunteered to make the call. The nice lady who answered my "911" said that I would have to call 566-3406, that she could not take the report unless someone was hurt. Okay, big deal, so it costs 10¢ – the gal on 3406 said that I had the wrong burough, that I should call another number for trouble in Brooklyn – and I said hold on here now, I'm trying to be helpful so don't make it difficult for me – and she said well all right, where's the accident.

When I finally gave her all the information I stepped out of the booth and called YJZ to let him know that the report was in and acknowledged. I was interrupted by WA2OMZ with an accident on the Major Degan – with an ambulance needed right away. I tried 911 and found them most cooperative when I had a damaged person involved. They took down the location of the accident and said they would get the word out immediately.

By the time I reached 65th Street, OMZ called to say that the ambulance had arrived and picked up the woman, who was in shock.

Now this may be an everyday occurrence to the blase SUR addicts, but it is exciting and hot news to those of us from the sticks – and by New York

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

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FREE KIT CATALOG: Tone Encoders, Decoders, Scramblers, Alarms, Sounders, Automatic Telephone Recorder Phone Patch, IC Kits and more KRYSTAL KITS, 2202 S.E. 14th, Bentonville, Arkansas 72712.

EVANSVILLE, INDIANA TARS Hamfest. Sunday May 6, 1973. 4H grounds Highway 41 North 3 miles. For flyer contact Robby W9MKZ, 502 S. Lincoln Park Drive, Evansville, Indiana 47714.

WANTED OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave N.E., Kirkland, Wash. 98033.

GREATER BALTIMORE HAMBOREE, Sunday April 8 at 10 A.M. Calvert Hall College, Goucher Blvd. and LaSalle Road, Towson, Maryland 21204 (1 mile south of Exit 28 Beltway-Interstate 695), Food Service, Prizes, Flea Market, Registration $2.00. No table charge or Percentage. INFO. Contact W3WVC at School Address.

STERLING-ROCK FALLS HAMFEST March 11th. INFO Box 11, Sterling, Ill. 61081.

CANADIANS – FREE 120 PAGE ELECTRONICS CATALOG. ETCO, 464 McGill, Montreal.

TO SELL YOUR HAM GEAR or to purchase new or used or to receive our monthly mailer of reconditioned equipment contact Associated Radio, 8012 Conser, Overland Park, Kansas 66204. 913-381-5900.

SOLID STATE Model T1352 Motorola RCC 7-Channel Secode VP Call Head, Antenna, Cable. Cost $1488 Sell $690. 610 S. Arroyo Pkwy, Pasadena, Ca. 91105 213-684-2000.

WA8TMR deceased. Wife must sell Swan 500CX single sideband transceiver and Power Supply 117XC. Excellent condition. Mrs. John Sercia Box 144, Brookfield, Ohio 44403.

GREATER BALTIMORE HAMBOREE, Sunday, April 8, at 10 AM, Calvert Hall College, Putty Hill and Goucher Boulevard, (one mile south of Exit 28-Beltway Interstate 695), Towson, Maryland. Registration: $2.00. No table charge or percentage. INFO: Joe Lochte, 5400 Roland Avenue, Baltimore, Md. 21210.

"22nd ANNUAL Dayton Hamvention will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt, flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. M Box 44, Dayton, Ohio 45401."

HERE'S YOUR CHANCE. Regency HR-6 $190, HR2MS 8 ch. scanner 15W $255. TME-H-LMU 16 ch. scanning rcvr 6/2/¾/m $255. Digital logiclock $75. Tempo CL220 12 ch. $265. Everything brand new. Box 310, 73 Magazine.

FOR SALE: SB110 and power supply $300.00. Clegg 66'er $125.00. Ameco 621 VFO $40.00. Ed WA1DDN, 18 Wilder St., Middleboro, Mass. 02346 (617) 947-6167.

HILLTOP HOMESITES. 4 A. near beautiful Amherst village, $7500. Vermont mountaintop near Hanover, N.H., $35,000. Photographs available. AMHERST HERITAGE AGENCY, Amherst, N.H. 603-673-6161.

FOR SALE: SRR-13 receiver – working – as is – w/manual $75.00 CV-591 SSB converter $60.00 Shipping prepaid. Pat Butler 3829 N. Harmon Peoria, Illinois 61614.

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FOR SALE – Brand new Heathkit all assembled SB 301 receiver and SB 401 transmitter. Selling due to demise of W1MC. $500.00. E. Corby, 70 Crown St., Trumbull Conn. 06611.

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WANT HT-220's – best prices paid – now's your chance to get enough to buy a six channel fast charge Japanese HT. Give details and price first letter. Box 95, 73 Magazine, Peterborough NH 03458.

ANTIQUE radio equipment sale and swap session, dinner and program, A.W.A. Spring Meet, April 7, Canandaigua, N.Y. Write for details: Lincoln Cundall, W2QY, 69 Boulevard Parkway, Rochester, N.Y. 14612.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

VHF GEAR: Comco AC ground to air $50., Stoddart NMA4 receiver 88-400 MHZ plug-in $195., Fairchild T power UHF FB $60., New Hy Gain 64B beam $10., several BC348 HF receivers part AC converted. Basket cases: TI dual chart recorder and Rootes type super charger. Most with schematics. Wilson, WØKGI, 407 Pinebrook Hills, Boulder, Colo., 80302, 303-447-8692.

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standards, most of us are living in the sticks. Come on all you fellows in New York – get organized a little bit and let the rest of the world know what a day on SUR is like!

With a few cases like that we could make beautiful music to congress – to the FCC – to the newspapers. If FMers will send in reports of things like this, they will make the 73 newspages – and we reprint these from time to time for congress. Without your help and interest we have little to tell.

DAYTON — ONLY ONE DAY!

The PR for the '73 Dayton Hamvention arrived and we see that it is again going to be a one day affair. Curses! There is just too much doing in that short time. Between the world's largest flea market – the busiest program schedule of any convention in the country – the largest manufacturer's exhibition – and the largest conglomeration of hams who want to meet and talk with each other, there is just no way to even get half of it all done in one day.

Compare that to the four days for the Saroc convention which has perhaps one quarter or less the participation in people and manufacturers, and no program whatever worthy of note.

The result is that you have to decide whether you are going to the slow scan talk – the FM talk – the DX talk – or a MARS or Midcars meeting, all at about the same time. Pity the DXer who uses SSTV and is also on FM. If an amateur has any reasonable number of interests he never has a chance to get to the exhibits or the flea market.

Reason would seem to dictate that Saroc be cut to one day and Dayton stretched out to a whole weekend.

NORMAN LICENSE REVOKED!

One of the bombshells at the Saroc convention was news that the man who has run the convention as a one-man effort for these many years, Leonard Norman, had been recently called up by the FCC for reexamination of his Conditional Class license – and FAILED!

The Commission has been checking out Conditional and Technician licenses in various areas in recent months, in many cases following up on reported cheating. The high percentage of tickets sent in without even an attempt to pass the exam has raised eyebrows in Washington.

It is not known whether the Norman recall was routine, the result of a report on cheating, or even possibly involved with the FCC reaction to jamming of Wescars by two Las Vegas amateurs.

TIME FOR HISTORY

Say, old timers, some of you are getting along a bit and there is a chance that you might take some information with you that ought to stay here.

How will you feel in the next "life" if the only record of how things were was what historians are able to glean from back issues of QST?

We do need to have some sidelights on the middle years of amateur radio – on what really happened in the 30's – and the 40's. I began to be deeply involved from the 50's on, once I got into ham publishing, so I can take it from there, but nothing much has ever been written to fill everyone in on the Warner and Budlong years of the League.

A lot of the newcomers to amateur radio would like to know more about our history – and there are a lot of old timers out there who were quite involved with the making of that history. Let's get cracking and write some articles on this – who knows, we might end up with a book.

SUBWAY MOBILE

One day, while in New York doing some shopping, SR-C146 in hand, I broke into WA2SUR during the few minutes that the subway train takes to cross the Manhattan Bridge and had a short contact. The chap I managed to snag was complaining about my being in favor of one meg split.

Though time was limited, I tried to explain that the one meg split was, first of all, not my original idea – and secondly that it was no big deal to me one way or the other whether repeaters were 600 kHz or one meg. I pointed out that I felt that my function was to act as a communication medium, making sure that ideas are given consideration. If one meg is accepted it will be no feather in my cap – it will be to the credit of those that put it into action, if it works out well.

Then I asked the fellow why he was so bitterly opposed to any repeaters changing to one meg. He explained that he was a student and couldn't afford to buy a new crystal for WA2SUR, since he had so little money.

I reflected awhile over the concept of one man trying so hard to stop an idea on the basis that 50,000 or so amateurs should accept what he wants because he doesn't have the get up and go to earn $3.75 for a new crystal. Since I was on the air I didn't mention that 73 is looking for area representatives who can make good commissions selling subscriptions to 73 – or that there is money waiting to be picked off the trees (figuratively) in the security field – or that there are quite a few books on the market showing how to make good incomes in your spare time. There are so many ways to make money that it seems as if no one should ever be short of it.

FILM PROJECTS

Many clubs have at least one member who is into 16mm or super 8mm films. As a club project, you might talk over the possibility of producing a film for distribution to other clubs – or even distribution outside of amateur radio to other types of clubs. We need films which show the benefits of amateur radio – the fun to be had – the things we accomplish.

You could plan a film on moonbounce operations – or on repeaters – special projects of your club – DXing – helping the handicapped. There are a large number of approaches to making an interesting and valuable film.

Once you have the film made you can let it be known through the ham magazines that it is available for showing. If you charge enough for rental to pay for the print, you can have a little income for the club. And think of the prestige for the club!

ARE YOU A WRITER?

Perhaps you get the urge to write. There are so many things that amateurs would be interested in that one hardly knows where to start. You might tell about the most exciting contact you ever had – or the most unusual – or maybe what technical advances you see ahead in the next few years – what will the ham bands be like in the future – how about FM sets in a couple of years?

Or perhaps you've built something new and interesting. It does happen that amateurs are right in there on the newest of developments and not much comes out that a ham hasn't had a hand in. Let's keep the readers up to date on new developments. If you build a one chip receiver, write it up. Or a one chip transmitter. Etc.

...Wayne

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J. H. Nelson

Good (Open), Fair (☐), Poor (O)

March 1973

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Possible aurora 21 and 22

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	7	7	7	7	7	7A	14	14	14
ARGENTINA	14	7A	7A	7B	7	7	14	21	21	21	21	21
AUSTRALIA	21	14	7B	7B	7B	7	7	14	14	7A	14	21
CANAL ZONE	14	7A	7	7	7	7	7A	14A	21	21	21	21
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HAWAII	14	14	7B	7	7	7	7	7B	14	14A	21	21
INOIA	7	7	7B	7B	7B	7B	7B	14	14	7B	7B	7
JAPAN	14	7B	7B	7B	7B	7	7	7	7	7B	7B	14
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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	7A	14	14	14
ARGENTINA	14A	14	7A	7B	7	7	7A	21	21	21	21	21
AUSTRALIA	21	14	14	7B	7B	7	7	7	14	7A	14	21
CANAL ZONE	21	14	7	7	7	7	7	14A	21	21	21	21
ENGLAND	7	7	7	7	7	7	7B	14	14	14	14	7B
HAWAII	21	14	14	7	7	7	7	7	14	14A	21	21
INDIA	7	7A	7B	7B	7B	7B	7B	7B	14	7	7	7
JAPAN	14	14	7B	7B	7B	7	7	7	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	7	14	14	14A	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	14	14	7B	14
PUERTO RICO	14	14	7	7	7	7	7	14	14A	21	21	14A
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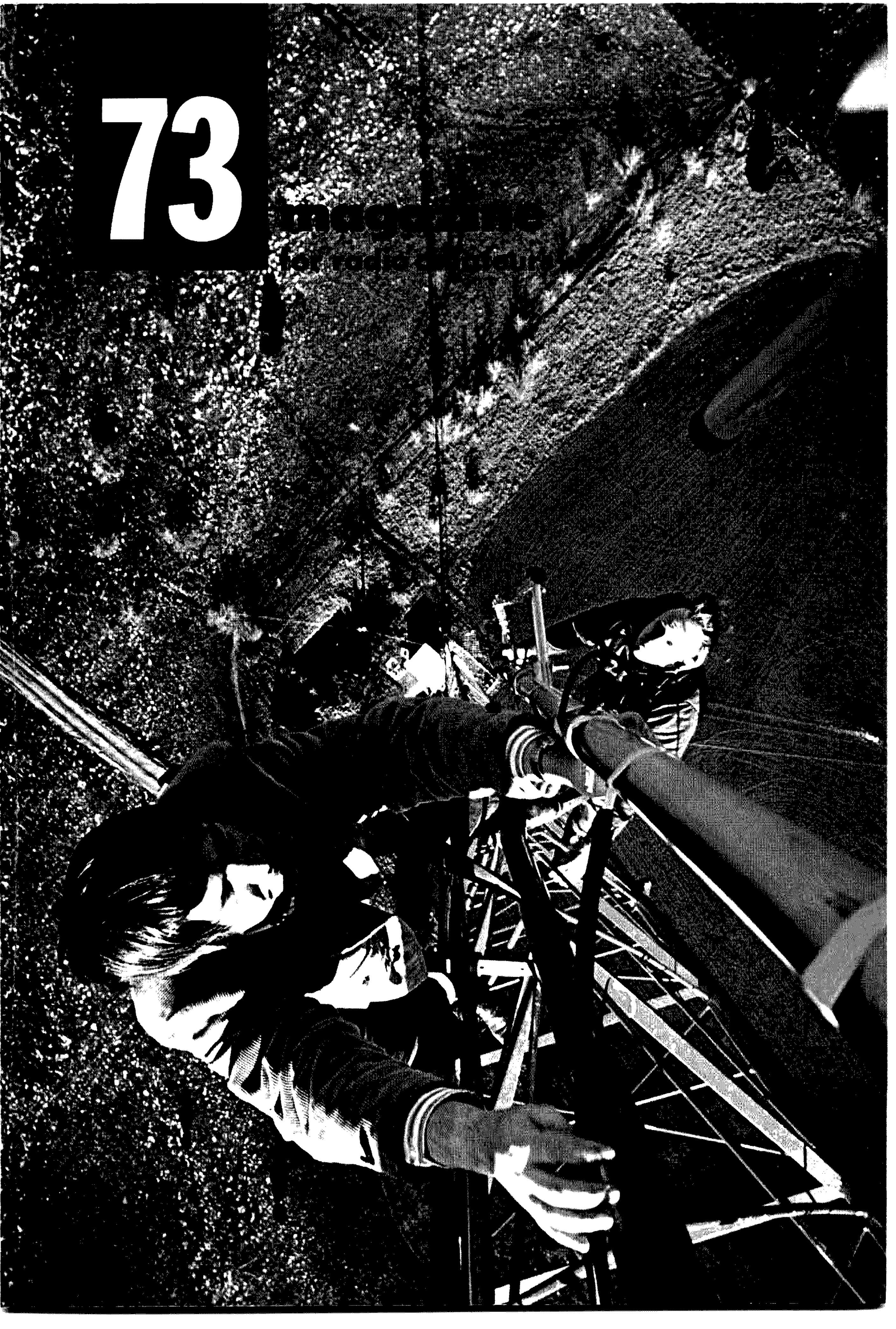
U. S. S. R.	7	7	7	7	7	7B	7B	7B	14	14	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	7	14	14	14
ARGENTINA	14A	14A	7A	7B	7	7	7B	14	14	21	21	21
AUSTRALIA	21	21	21	14	7B	7	7	7	14	7A	14	21
CANAL ZONE	21	14	7	7	7	7	7	14	21	21	21	21
ENGLAND	7B	7	7	7	7	7	7B	7B	14	14	14	7B
HAWAII	21A	21	14	14	7	7	7	7	14	21	21	21
INDIA	7	14	14	7B	7B	7B	7B	7B	7	7	7	7
JAPAN	14A	14A	14	7B	7B	7	7	7	7	7B	14	14
MEXICO	21	14	7	7	7	7	7	14	14	14	21	21
PHILIPPINES	21	14A	14	7B	7B	7B	7B	7	7	14	7B	14
PUERTO RICO	14A	14	7	7	7	7	7	14	21	21	21	21
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	14	14	14A	14
U. S. S. R.	7B	7	7	7	7	7B	7B	7	14	14	7B	7B
EAST COAST	14	14	7	7	7	7	7	14	14	14A	21	21

A = Next higher frequency may be useful also.
B = Difficult circuit this period.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for radio amateurs

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COVER: A lack and a lass, the nude cover for this issue didn't materialize. We did have it all ready to go, when someone happened to notice that the hand unit the model was holding was backwards – so back to the studio. Eight subscribers cancelled after seeing the February cover – and the newsstands reported selling 2,800 extra copies. That's a fair trade off, for a good percentage of those new readers will subscribe during the next few months. Time magazine had a similar problem with their recent Last Tango cover which precipitated about 500 sub cancellations and sold 56,000 extra copies on the newsstands. We'll try to have that nude for you in May or June, so hold tight. And Gay Libbers, quit bitching. In its place we are substituting a shot (from the 600 foot level!) of the antenna installation at the WØEMU 16–76 repeater site in Winfield, KS. See page 18 for the complete story. Remember . . . this *is* an FM issue!

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $7 for one year in North America and U.S. Zip Code areas overseas, $8 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A. *Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 221 Rock Hill Rd., Bala Cynwyd PA 19904.*

Amateur Radio

APRIL MCMLXXIII — Monthly Ham

CHICAGO HAS VOTING MACHINE!

The Chicago FM Club recently tested a General Electric Voting System on their two meter 16/76 repeater. The voter selects one of four sites on the basis of "quieting." After six weeks of use, CFMC decided to purchase the comparator.

Shown here is the happy moment when the first commercially built voting system became part of an amateur repeater . . . the handing over of the check. From left to right: Don Coleman WA9DZS, tech committee chairman; Sid Cohen, local GE rep; Jim King WB9BDS, tech committee; Mike Krut K9BHM, licensing committee; and Rich Casey WA9LRI, CFMC president, happily holding the receipt.

CANADIAN QSL BUREAU

CARF

The Canadian Amateur Federation Inc. is glad to make this new national bureau available to any QSL bureau in the world for cards coming into Canada. Canadian cards may be sent in bulk and will be promptly sorted and distributed to the ten provincial bureaus. There is no cost to anyone for this service. Cards are welcomed from individuals as well as bureaus. The address is: CARF National QSL Bureau, P.O. Box 66, Islington, Ontario, Canada M9A 4X1.

HAMS AID CRASH VICTIMS

Last February radio and television shows were interrupted with a terse announcement that a plane had crashed into an Alameda CA apartment house. Details were so sketchy as to be non-existent. By 11 p.m. the news reported a Navy jet had screamed into a three-story building with the possibility that none of the occupants had escaped . . . that dozens may have perished.

Alert to the possible need by the American National Red Cross for emergency communications was Charlie Weber WA6RPK, a member of "The Repeater" Club, Mountain View CA. He contacted board member Roy Everhart WB6GWQ. Roy, in concert with trustee Al Nielson WA6AGA, discussed the situation and officially committed the resources of the club during the emergency. Adolph Kelly WA6CCG works in Alameda and was on his lunch break when the jet hit. His quick reconnaissance confirmed a need for the service amateur radio and Grizzly Peak could provide.

Forces quickly gathered with Don Smith W6NKF and Mach Myovich K6KAP at the scene with portables linking them to Betty Smothers WA6GCS at the Alameda Red Cross headquarters. Betty and her relief compiled a 17-page radio log before they finally secured operations some 3 days later.

Many reported to and remained at the scene throughout the night as the fire blazed. Still more made themselves available for uncounted hours during the gruesome cleanup and search for victims. Personnel were located at the scene, the Red Cross Alameda chapter office, and the Oakland ARC office. This provided the communications link needed to allow Red Cross staffers and volunteers to meet the emergency needs of the victims as well as to provide logistics support for the cleanup workers.

Col. Harrison and Mr. Harris, representing the American National Red Cross, expressed to the club that they were thankful that the hams arrived and so professionally assumed the significant role that they did. They felt the communications provided were the most professional they have utilized at any previous disaster. They were pleased with the accuracy of the traffic being handled, a fact important to them since the data included vital statistics of the rescued as well as the fatalities.

The utlimate compliment to the hams came when — as the phone link was being established — a request was made to have the radio operators continue their duties over the phones since they were so proficient as message handlers.

Members working any disaster or public service event are cautioned that persons not directly connected with the operation may assume incorrectly that you are an official spokesman for the group you are assisting. Therefore, be careful not to pass on traffic, requests, etc. unless originated by an official. Persons receiving such a message will assume it is from someone with authority to request or direct the action and will comply, not realizing the request is not "official." Organizations such as the Red Cross and Salvation Army normally designate a Press Representative who is knowledgeable of his group's press policies and who will provide releases to the media. The best thing to remember is that we are assisting by providing communications and not actually running the operation.

SPECTRUM CHART

The FAA recently published a 32" by 34" radio spectrum chart showing usage from zero to 300 GHz. Copies are available at 40¢ each from the Government Printing Office, Washington, D.C. 20402. Request FAA Electromagnetic Spectrum Chart, No. TD 4.27:E12.

News Pages

FREE COFFEE ALONG HIGHWAY

Reprinted from Corvallis Gazette-Times, Corvallis, Oregon.

That "Free Coffee" sign on weekends at the entrance to the Blalock rest area on Interstate 5 south of Wilsonville can be ignored for only so many trips. Then curiosity wins.

And, come to find out, the complete project is a volunteer effort by a band of radio hams from the Portland area. They group under the name of Mobile Communications Emergency Unit.

What's the idea? Because they're a bunch of nuts, the sign says, and the casual host behind the urns corroborates the claim. In that case, there should be more nuts just like them.

They're convinced that a break from driving puts the motorist back on the road more alert and less prone to make poor judgments resulting in accidents. The free coffee is just the gimmick to entice the driver to stop.

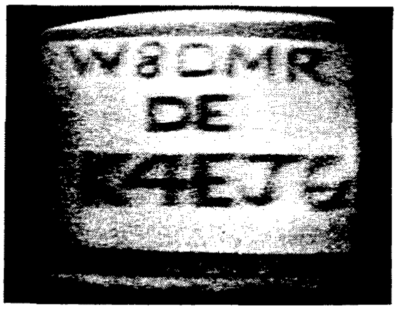
Most weekends they also operate four mobile units patrolling the freeway between Portland and Salem. They assist stranded motorists, fetching gas, radioing for repair service or tow truck, aiding anyone who needs help in any way they can. Contributions deposited in a container at the coffee-tea counter pay for part of the expenses. These are Good Samaritans in action.

Mobiles Check Freeway Conditions

KMPC, long the acknowledged leader in traffic coverage, has added more than 50 more freeway reporters each morning through a unique "Amateur Radio Network."

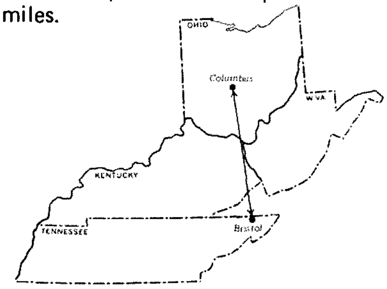
Headed by Frank Mead (WA6UJJ), the group, which is officially the WA6TDD Morning Network, utilizes the Mt. Wilson based transmitter of Burt Weiner (K6OQK) to augment reports by KMPC Airwatch helicopters and mobile units on Southern California freeway conditions.

These reports by the more than 50 work-bound hams are in turn monitored by Dave Glawson (WA6CGR) and Chris Williams (WB6HGW), who utilizes special phone lines to transmit the information to KMPC News.



OHIO-TENN. ATV QSO

Last Nov. 9, after extensive preparation, K4EJQ received the accompanying picture from W8DMR on 435.9 MHz. "Bunky" K4EJQ lives in Bristol TN and runs 500W into a 40 el. array. Bill W8DMR runs 100W into a 48 el. array in Columbus, Ohio. The estimated path between points is 250 miles.



EL2CI PROVIDES MEDICAL LINK

Zorzor, Liberia, Africa

An outbreak of Lassa Fever occurred in the Zorzor district March 1972. Spreading from an obstetrical patient, ill at the time of admission to the Curan Memorial Hospital in Zorzor, the epidemic affected seven staff members and two patients. A nurse, an aide, and two patients died. Two patients, two midwives and three midwifery students recovered.

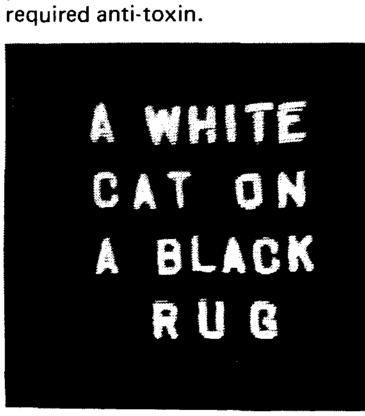
Lassa Fever is a severe viral illness first identified in Northern Nigeria in early 1969 and recurring in epidemic form at a hospital there in early 1970, when 28 cases with 13 deaths were recorded, including the death of a physician who pricked herself during an autopsy. The complete history of the case and its consequences was reported to the Liberian Medical Association by Dr. Paul Martens who was then the physician-in-charge at the hospital when the epidemic struck.

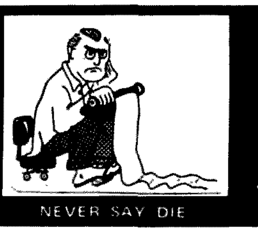
EL2CI, during the epidemic established radio communication between Zorzor and Monrovia and also between Monrovia and the Center for Disease Control in Atlanta, Georgia.

The communications made possible the rapid identification of the disease, and later permitted the coordination between Zorzor, Monrovia, and the CDC as extensive investigation was carried out by Dr. Patton, a U.S. citizen, resident cardiologist at the John F. Kennedy Medical Center, Monrovia. He took an active part in the epidemic by defining the information and putting it in medical terms for transmission to the Center for Disease Control. He was actually in EL2CI's QTH during most of the transmission.

GIRL SAVED

Estele Maria Azar, an 18-year-old girl from Mendoza, Argentina, is recovering from a case of botulism which killed her 12-year-old sister when they ate a tainted can of beans. Argentine hams contacted American hams who reached Mount Sinai Hospital in New York, and they sent the required anti-toxin.





...de W2NSD/1

EDITORIAL BY WAYNE GREEN

PETITION!

The FCC has failed us utterly and completely with the repeater regulations, and we have to make this fact known to them. The principle of "least regulation" has been made a mockery by this over-restrictive set of rules.

Let's make our will known – with a petition. If we can present a petition with several thousand names and calls on it, they will have to listen – and give us relief.

Please make a copy of the below petition and get it signed by as many amateurs as possible – any class of license – and send it to 73 Magazine, Peterborough NH 03458. Please make sure that your petitions are in the mail to me by May 15th, at the very latest. I will make copies of the petitions and send them to the individual FCC Commissioners – to Barry Goldwater – and I will hand carry the originals to the Chief of the Amateur and Citizens Band division.

There are about 1000 repeater groups around the country, and I would hope that we would have 100% cooperation in this from them – which should mean that we could end up with 10,000 to 20,000 signatures. Please do whatever you can – with petitions for signatures in every radio store – at every club meeting, whether it be a repeater club or not. Let's do something this time and let the FCC know that we are interested and that it is important to us.

If we can make ourselves heard, we stand a much better chance of getting attention to our complaints on other legislative matters. If we never take a stand, we are as lost as sheep.

Copies of the petition form are available from 73 Magazine, Peterborough NH 03458 if you send a sase. Please use 8½ x 11 paper and sign on one side only. Please be sure to make the call signs readable.

When you read this, please call in on every repeater you can and see what you can do to organize petition signing meetings – get small committees to go to visit members who can't make the meetings – let's get out the vote using every strategem we can devise. Let's not have any slackers on this.

FCC SHAME

Repeater groups who discover a bootlegger in their midst may in the future think several times before appraising the FCC of this uncomfortable circumstance. The recent events at Phoenix are enough to convince any prudent person that perhaps the last people to be notified in case of such a difficulty is the FCC.

It seems that the trustee of the local repeater discovered that a well known local was a bootlegger when he applied for membership in the club. The first reply said essentially that he should mind his own business. He tried again and eventually the Commission sent two agents to look into the problem – which by the time they arrived had been solved.

The agents turned their attention to the repeaters and were able to find several aspects that weren't in line with the latest rules... so the club had to shut down the repeaters. This brought an eviction notice from the TV station – with the result that three two meter repeaters, one six meter repeater and a 450 repeater went off the air.

One repeater is on part time on 34–94, operating from the trustee's home, when he is home to control it. The 16–76 autopatch machine is on now and then too, but for the most part repeater operation has stopped in Phoenix.

The FCC should be proud of this. It certainly will stand out as a monument to the futility of trying to cooperate with the Commission.

AMATEUR CD RESPONSIBILITY

Not a few amateurs have wondered at the lack of enthusiasm exhibited by our government as far as civil defense is concerned. Talk about benign neglect! Recent information seems to indicate that this is quite intentional – that CD is being left to wither away on purpose.

Continued on p. 119.....

PETITION

I hereby petition the FCC to reconsider docket 18803.

Call	Name	Address	City	State	Zip
W1MUL	Paul Ramsden	3 Daniel Webster Dr	Hudson	NH	03051
W1DRP	John C. Tirrell	164 Cypress Ln	Nashua	NH	03060
W1PVF	Sanford H Cole, Jr	25 Pine St	Littleton	NH	03561
WA1NYS	Herman Habermann	[illegible]	Nashua	NH	03060
K1CKS	Hugo A.N. Simm	11 [illegible] Av.	Everett Mass	Mass	02149
W1TL	A.P. Sallet / a P Sallet	25 [illegible] Ave	Nashua NH	NH	03060
W1VKP	John F. Kenney	19 Bryant Rd	Nashua N.H.		03060
W1GQV	Patrick E [illegible]	58 Yarmouth Dr.	Nashua N.H.		03060
K1ZBJ	[illegible]	7 Depot St	Merrimack	NH	03078
WA1NXI	Michael [illegible]	75 [illegible] Dr	Merrimack	NH.	03059
W1JOF	Allan R. [illegible]	[illegible]	Hudson NH	—	03051
W1BHD	Melvin H [illegible]	30 [illegible] St	Malden Mass.		02148
WA1QQR	Charles [illegible]	42 [illegible] St	Milford N.H.		03055
WA1EDG	Richard P [illegible]	22 [illegible]	Hudson NH		03051
K1DDE	[illegible]	Devonshire Lane	[illegible], N.H.		
WA1ERK	[illegible]	C5 Linton St	Nashua	NH	03060
K1ACX	Gerald J [illegible]	RFD 4, Box 165	Manchester, NH		03102
W1FSM	Curt Seaton	7 [illegible]	Chelmsford, Mass		01824
WA1[illegible]	[illegible]	[illegible]	[illegible] ME		[illegible]
K1GQZ	Joseph C [illegible]	46 Royal Crest Dr	Nashua N.H.		03060
WA1GRH	Arthur J. [illegible]	4 Forest Glen Cir	Woburn MA		01801
WA1QEK	[illegible]	46 Crescent St	Lawrence, Mass		01841
K1YCN	Bruce F. [illegible]	360 [illegible] Avenue	Haverhill Mass		01830
WA1RKN	Michael [illegible]	[illegible]	Milford, NH		03055
K1MNS	[illegible]	Warner Hill Rd	Derry N.H		03038
WA1MEK	Joan A [illegible]	Warner Hill Rd	Derry	NH	03038
WA1FPP/1	Ron Sallet	Rte 136	Francestown	N.H	03043
W2NSD/1	Wayne Green		Peterborough	NH	03458
WL6RO	R.E. "Ash" Gardner	PO Box 221	Peterborough	NH	03458
WA6ULW/1	[illegible]		Peterborough, New Hampshire		03458
W7DXX/1	Kurt R [illegible]		Peterborough, New Hampshire		03458

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	38.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

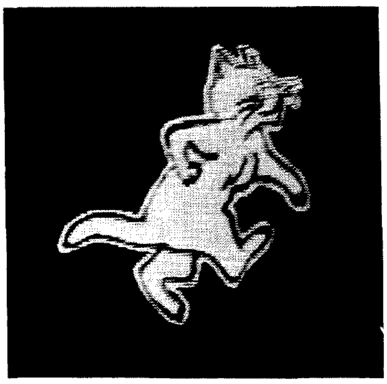
SSTV Frequencies

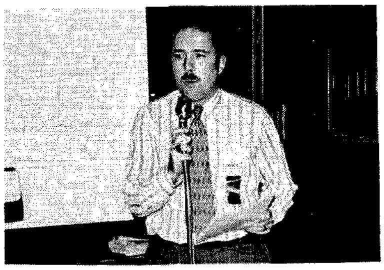
	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

SSTV SCENE

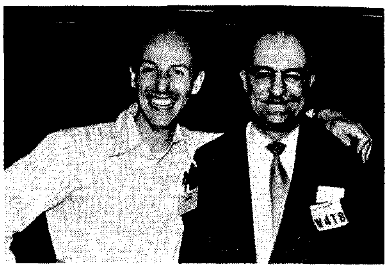
Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

The big event this month, stateside, is the Dayton convention on April 28 and 29. This super fest is the major Slow Scan gathering of the year. There's a certain excitement around the SSTV booth created by recognizing "in person" the fellows you've seen and QSOed on the air, and usually some great ideas, information, and schematics are discussed by their designers during the forum, often months before appearing in any magazine. Taggart WB8DQT, recently designed a nice, yet relatively inexpensive electromagnetically deflected monitor, and I understand he will have the monitor and information available on it. Three or four of the fellows are working heavily on Fast to Slow Scan converters, so these may be unveiled for the first time here also. And don't forget the flea market. Although used SSTV gear is still rare (who wants out . . . everyone wants "in"), there are usually some hard-to-find parts available.





Ralph Taggart WB8DQT, emceeing SSTV Forum.

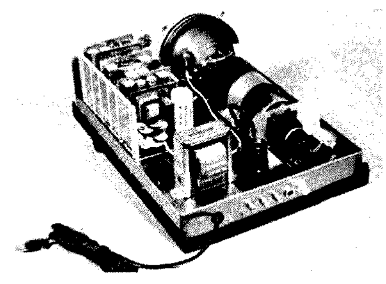


WØLMD/4 (Bob) and W4TB (Nick) make up after their "floor fight" on competing SSTV theories!

This month's pictures of the 1972 Dayton blast were snapped during the highly successful ATV forum by Gene W1VRK, who incidentally was also in the program.

Larry WA9MFF, sent along some pictures this month of his interesting Slow Scan monitor. The homebrew W6MXV/WØLMD type monitor is built in a Drake TR-4 cabinet, and looks professional. Circuitry is on six plug-in cards, and the bezel is handformed plexiglass. Larry may write a full article on his monitor in the near future.

This past winter 20 meters often "closed" quite early here. As an alternative I would switch to 40 meters, and was surprised to find so little Slow Scan activity. Maybe this is due to the recent frequency shifting, or the popularity of 80 meters; however don't underestimate 40. The static level is lower and skip conditions better, providing at least continental coverage. Before the recent frequency shift Slow Scan activity was on 7220 kHz. The new Advanced Class allocation is 7150 to 7225 kHz, thus we are still within the band and no frequency change was necessary. In fact, we now have room to stack back down the band as activity increases. "See" you on 40?

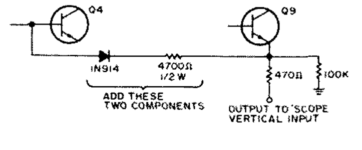


The W6MXV/WØLMD monitor built by WA9MFF.

Robert Suding WØLMD has designed a nice 50 to 60 cycle line converter I am sure those of you overseas would like to build. We are hoping it will appear in print at least by this fall. If you are super anxious for the information and write either Robert or me, be sure to include sufficient IRCs to cover postage and copying.

9Y4VU recently joined our SSTV ranks. Frank presently uses a Macdonald monitor/tape recorder setup, and is building more. Watch for him on 20 meters. Let's see . . . that should put us up to about 70 countries now on Slow Scan.

The following circuit is a modification for the ever popular 'scope adapter, and compliments of Brooks W1JKF. A 4700 ohm resistor and any low level diode form a feedback path in the vertical sweep circuit (Q4 through Q9). This effectively closes the vertical circuit after its sweep pulse, until approximately time for the next pulse. The result is that QRM doesn't hold the intial trace at the screen top. Another modification for an already legendary circuit.



Word is just in from J&R Electronics on some late gear modifications. Their MXV-100 monitor now boasts an 8 inch crt for a larger picture, and a new oak cabinet. Nice, eh? And it works beautifully. (See the MXV-100 product report, 73 Magazine, Jan. 1972, pg. 5 & 8.) The automatic light compensated camera has an optional 1, 2, or 4 scans per 8 second frame capability. Thus in the "4 scan" mode, the top ¼ of your picture will be displayed 4 times on the monitor screen.

73 . . . Dave, K4TWJ

DX FOOTNOTES

GUS M. BROWNING W4BPD

Well I see that good old summertime is around the corner, this means there will be some changes in the bands, and best of all the WX will be right to get your antennas "right" ! I had a very FB "looking" 4 element, tri band quad, all put together, boom, elements and all. It was just tied down to the bottom of my 150 ft. tower, just high enough to clear the ground. I was trying to get it put on top of my tower and winter WX and a lot of rain and wind stopped me and then it turned cold and winter was upon us. I decided that I would just let it stay there until summertime came around again. I could see, getting this "thing" put on top of the tower was going to take a lot of "doing" and a lot of hand-shaking and back-slapping to convince someone to climb up and down that tower (the days of one of the neighborhood kids doing such things has passed, even "down-south), well, like a few years ago we had one more of those ice-storms (we don't get snow-hi.) This one caused a lot of havoc, many thousands of trees fell and you should have seen W4WVF's FB quad. It looked like a very wet spider-wed and worst of all it looked like a wet spider-web that someone had than stepped on ! This is the 3rd time his quad has suffered a calamity on account of ice-storms. It took the high winds all OK, but those ice-storms were "murder" ! Mine even looked a mess down at the bottom of my tower I could see that I would have been in "big trouble" if it had been on top of my tower. To be truthtul about the whole thing, I have "chickened-out" on putting it up, knowing that sooner or later there will be another ice-storm and it will crumble up and I would than have the whole thing to do over. again. I would rather have a half loaf of bread than none ! I am going to put up a multiple dipole for every band from 10 through 160 meters and feed it with RG17AU and accept what-ever SWR I happen to end up with. It might end up being broad-banded with all that wire up there and be non-directional. At least I think I will have up an antenna that will stay up and it will be "all-band". I will "worry" about putting up my 4 element, tri-band quad on a pole that I can put up and down by pulling a few ropes when there is the next ice storm coming this direction.

With the diminishing sun spots and conditions getting worse on the high frequency bands its about time to be looking into the lower frequency bands. The antenna is the first thing to get up and the best time is during the summertime, which is practically upon us right now. Those lower frequencies will be our "bread and butter" bands pretty soon now, so you had better start getting ready for them right now. The DX stations are getting more numerous on the lower freq-uencies and as the sun-spots get less and less the DX stations will get more and more.

Peggy (my XYL) and I are right now working on our "last" DXpedit-ion which we hope to commence in March of 1974, we hope that it will last from one to two years, maybe even longer (as long as our money and donations permit.) Peggy is right now in the process of getting herself a license. We will dish-out YL and OM QSO's from as many countries as possible. The YL ISSB group is behind us on this trip, they will be helping with contributions to keep us on the road as long as possible. I told V. Mayree (K4ICA) that we had the time if they had the money ! Their "contributions" "acceptor" is K5LIL. All this means that when Peggy and I get on the road you will be able to work us if you anchor your receiver on the YL ISSB System frequencies sooner or later you will hear us break in on them. Then you can work yourself a YL and OM in some DX spot - two QSO's without much trouble ! We will be on all bands that are open after we attend to the YL's on their frequencies. Plenty of low frequency operation is planned since the higher frequencies are gradually going out. Get ready for us because we want plenty of "business" when we get on from "out there" !

Some of the DX coming through on 160 meters will surprise you if you stick it out and can battle the summer-time QRN that will start pretty soon now. Some of the DX worked on this band since Jan. was some pretty good stuff, such as: 8P6DR, YV5CKR, LU5HFI, KH6RS, EP2BQ, VP8KF, PY1DVG, 4W1AE, HB9CM, JY9FOC, DL1FF, PJ2VD, OA8V, OE5KE, HR2HH and KP4DLW - All these between 1825 to 1830 kHz at all kind of hours of night. Some pretty good DX, even for higher frequencies. If this is a sample of whats being work-ed on 160 right now there certainly will be some real DX activity there when the sun spots get nearer the bottom of the 11 year cycle.

The operation of the Canadian World DX-pedition to Bhutan is off. They received a letter from the Bhutan Ministry of Foreign Affairs infor-ming them that the Government of Bhutan has standing orders that no visitors are to be allowed to enter Bhutan until the end of 1973 and even after that, only package tours of 6 to 10 persons will be allowed. So if you were waiting for them to go there to work your A51 country you can "forget it" for the present time.

MOUNT ATHOS - The ice was finally cracked in getting someone on the air from this rare spot in Greece. It's somewhat like Vatican City, which is located in Rome, Italy as you know, only Mount Athos is located in Greece. I can tell you from personal experience it took some "doing" to get permission for this operation. Many, many fell-ows including myself have been trying for years to do the "trick" without any success what so ever. NOW I guess the next rare spot to be cracked will be The Royal Order of The Knights of Malta set up which is one square block right smack in the center of Rome, Italy. I have heard that it has all the ear markings of being another "new one" if ever anyone gets "official permission" to operate from there.

I WONDER when (if ever) will ARRL decide that there are TWO Viet-Nam's, TWO Germany's, TWO Korea's ? I have not ever heard complaints that there are too many DXCC countries. In fact there are MORE DXERS that would like to see MORE countries on the DXCC country list than less. Far too many DXers have worked all the countries on the air and it seems to me like they want "something" to do. By this I mean real "DXERS", not the garden variety of DXer who thinks a G3 or DL is DX. I mean the serious DXER, the fellow that gets each "new one" as they come on the air. For him, the more DX there is the better he likes it.

WANNA WORK DX EASIER ?

All you have to do is listen more and talk less. Listen what the DX station has to say. If he says W/K1's only, and you are not in the first district KEEP YOUR MOUTH SHUT, QRX until your district is called and then VERY SHORT calls, no need to mention his call much BUT give yours a few times (he knows his call, but not yours), use only STANDARD phonetics, or better yet if you know his language use it. When you get him, give him ONLY his signal report LET HIM indicate if he wants a rag chew. Lastly, if the deliberate QRM on him is someone YOU KNOW, be sure to get an immediate message or better yet a phone call to the nearest FCC monitoring station. I myself would call them if these shenanagins was being done my my own brother. See you on the "Low-End"-de Gus

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

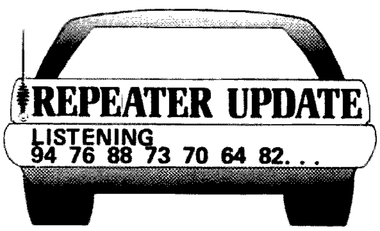
☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

PHIL-MONT GOES FM

The Phil-Mont club, one of the larger in the country, is going FM, starting on 147.03 simplex and installing a Standard repeater for 147.63–03 later on. This should give quite a boost to FM in Philadelphia.

NEW LICENSE ARRIVED?

When your repeater receives its new WR call, the second thing that you should do (after changing the identifier) is fill out the above form and mail it to 73. This will enable us to keep our repeater listing current and accurate. It will also make sure that the FM world doesn't forget you . . . for the 73 Atlas is recognized as the one complete listing of repeaters for the entire world.



WR CALLS APPEARING

AZ	K7EIK	Kingman		18–78
			T1.8	34–94
GA	WB4RYQ	Griffin	Delete	
IL	WR9AAA ex-WA9EAT	Joliet		28-987
MA	K1CRR	Webster		28–88
MA	K1ADI	Oxford	Delete	
MI	WB8CSU	Jackson		13–73
MN	KØPML	Mpls-St. Paul	T1.8	16–76
MN	WØPZT	Mpls-St. Paul		22–82
MN	WAØJCX	Mpls-St. Paul		28–88
MN	K2OPT/Ø	Albert Lea		34–94
MN	WØGVP	Duluth		34–94
MN	WAØDDF	Rochester		34–94
MN	KØRTU	Elk River		37–97
MN	WAØNPZ	Mpls-St. Paul		94–46
NC	WB4QGE	Winston-Salem		04–64
NJ	WB2ZQG		Delete	
NJ	WB2ZWQ	South Jersey		22–82
NY	WR2AAA ex-WA2SUR	Manhattan		13–73
PA	WA3KXD	Erie		34–94
				19–94
PA	WA3KXF	Lancaster		91–81
SD	WØBXD	Brookings	W1800	34–94
SD	WAØVVG	Sioux Falls	W1477	34–94
SD	KØRTD	Pierre		34–94
SD	WØDGS	Aberdeen		34–94
SD	WAØCPX	Rapid City		34–95
TN	W4SKH	Moved to Knoxville		28–88
TX	K5WPH	El Paso		28–88

As the April issue is nearing its deadline, word has been received that two WR repeater calls have been issued by the FCC – WR2AAA to WA2SUR in New York and WR9AAA to WA9EAT in Joliet IL. Note that both applications were for minimal, non-complex installations.

See the article on page 51 of this issue for details on how to insure that your application is processed quickly and with the least amount of problems.

UPDATE THE UPDATE

Your new repeater, or your present machine with its new frequencies, is destined to remain practically unknown to the rest of the world unless you get the information to the Repeater Update . . . pronto!

All published updates are automatically compiled by our computer-like staff and added to the listings in the Repeater Atlas. While you can always (horrors) chop-up every issue and compile the new listings as they are published, an easier way is to send us a buck and a half for a copy of the brand-new-still-wet 1973 Repeater Atlas. It contains a listing for every repeater known, including maps, open or closed status and tone frequencies. See our ad on page 126 for that little extra bit of convincing.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

Early February has been most unusual. There have been multiple E openings in many areas. Openings of this type and frequency are not normally expected until the beginning of the summer E season. The band has been open at least eight times during the first twelve days of the month. Areas heard include Maryland (WA3PNQ) to Florida and Louisiana (WA5UUD) in the south and west to New Mexico (W5TDZ) and Arizona (WA7FPO). I had a nice QSO with WA4CRK, Cary NC the other evening. Jim runs Johnson equipment and a four element beam on AM and does a nice job with it. I have seldom heard a more stable signal, the drift being essentially zero as copied on a SSB only receiver.

WB4BVT of Tateville, Kentucky, wrote and called to tell of an unusual occurrence the evening of February 4th. At approximately 7:05 EST David heard and recorded a station signing JA1SGY. Several replays of the tape confirmed the call which is not, however, listed in the Callbook. Has anyone heard or worked this station? David runs a Swan 250 and Mark 6 linear with a CushCraft beam.

Art WA1EXN, says "I thought I had publicized it pretty well on the band. However, I still hear of fellows having parasitic problems with the January 1969 QST modification of the SB-200 Heath linear. You might mention that all they have to do is replace the 47 ohm resistors in the plate choke with 100 ohms and it will cure it. The same coil form can be used. This in the (ARRL) Handbook, page 430, 1971 Edition. The original article fails to mention this and the uninitiated cremate the 47 ohm jobs and stink up their shacks for a week or so."

Hugh WBØHUP, has RTTY gear and is looking for contacts. Any takers?

Louis Ancioux WB6NMT/6, is looking for EME schedules. Anyone ready to go before mid-June (when he changes QTH) should drop him a line at NAVRADRECFAC, Scaggs Island, Sonoma, California 95476. Louis has a 28 dB rhombic at his end and suggests that those with a quad of 6 elements spaced one wave length should be able to make the grade. It might even be possible with a pair.

The SB-110 makes an excellent code practice set without internal changes – merely switch the function switch to "CAL" with the rig set up for CW. The sidetone works as usual providing aural indication of keying without transmitting a signal.

Some years back Telco produced a 6 meter linear utilizing four external anode tubes; can anyone supply a copy of the manual for this unit? Even a schematic would be helpful to the current owner.

Many thanks to those who contributed to the first year of "The 50 MHz Band." Your efforts and kindness are truly appreciated.

WAØABI

HAM HELP

Occasionally 73 receives letters from aspiring amateurs wanting to know if we can locate someone to help them get their license. Perhaps there are many more of our non-ham readers who also desire help.

Starting with this issue, we will publish names, addresses and telephone numbers of those desiring assistance. If you need help, don't be bashful about sending us your name . . . you do want your license don't you?

Each month, amateurs and clubs should look the list over and give a hand to those in their area. As new names come in, previous names will be removed from the list.

Earl L. Grove
891 Commonwealth Ave
Venice CA 90291
213-398-7315

1Lt Olin L. Beall II
530-34-9383
Hq Co
USA CCD
APO San Francisco CA 96460

Oatley W. Wells
RFD 1
Concord NH 03301
603-746-3916

novice

Schley Cox WN9LHO
219 Kilgore Avenue
Muncie IN 47305

THE RANK AMATEUR

Being a Novice operator is one of the broadest activities in ham radio. One of the problems with writing a column for Novice operators is that most of the ham columns are written for specialty areas like Oscar, 50 MHz Band, MARS and SSTV.

Novices do have one thing in common. We are almost all just beginning. Some of us have worked some DX, but haven't been able to get a QSO yet in the state just next door. Some of us have a code speed just at 5 wpm (unless there is QRM) and a few of us could shut down a lazy amateur Extra.

Most of us didn't have too much trouble getting our first ticket (that's hindsight talking!) but once on the air we usually start our operating experience trying to get our 50-watt loaded dipoles through the QRM of 40 meter band carriers from Moscow, Sofia, London and Rome.

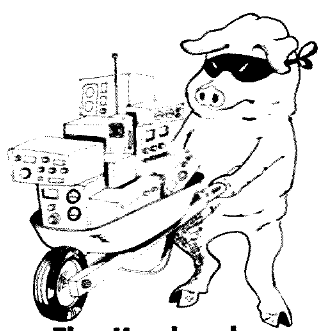
Despite that 40 meter international snake pit and Novice band, the 80 meter summer static, that yet inexplicable interference some of our transmitters seem to cause the kitchen toaster, and the strange glances of family and friends who ask themselves, "What can anybody do with a radio all night long?", most of us will try to get our General license.

Those who have gone on already to the higher tickets tell me that what we are doing now is the most enjoyable time we will have in ham radio. Sometimes the technical competence of a few years' experience takes a little of the edge off what we're enjoying so much for the first time right now.

This column will be written for Novice ops who plan to make their first years in ham radio two of the most enjoyable and productive they will ever spend. Future topics include what to do when you get the telegraph operator's version of mike fright, how to improve your fist overnight, operating contests, DX, traffic, antennas, maybe something on the perfect solder joint, and most important, about the things you tell me are on your minds.

I have some strong opinions about what's right and wrong with the Novice bands and my fellow Novice ops. You'll read about them in this column from time to time. If you don't like my opinions, or if you do, let me know. I've been known to be wrong before, and I'm sure I will be again. I frequent 3.717, 7.110 and 7.1440 in the early afternoons and on week ends.

WN9LHO



The Hamburglar STRIKES AGAIN!

The Hamburglar from Fun City has discovered FM!.Barry Electronics has lost an FM 27B Ser. No. 27013-1141 to the devious scoundrel. Wouldn't he settle for a cheaper rig?

Anyone with information please contact Barry Gensler W2LNI, c/o Barry Electronics, 512 Broadway, New York NY 10012, 212-915-7000.

The following gear was taken from remote field site near Knolls, Utah between October and December 1972.

1. Kyokuto Denshi Model FM144-10L 2 mtr xcvr Ser. No. F459.
2. NPC Model 107M marine 12V power supply.
3. Onan generator, green in color, ser. no. 327885, Model 2.5AJ-IPL.

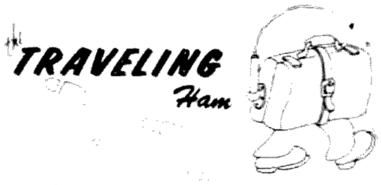
Contact Tooele County Sheriff, Tooele, Utah, or Peter T. Rowe WA6WOA, 316 Escuela #72, Mt. View CA 94040.

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Swan Cygnet 270,No. 313022	K4ACJ	9/72
Collins Mic, Mod. MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No. M-395430	W8HST	11/72
AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No.112007	WA8PCG	3/73

SNZG YKEDF BKVG VLF Z V F K D Y C G N Z Y Z XJTXEFKQGKLY GL XDRDYGH GNFDD?

ZED BLLCSKY



Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

This month I have been taking a look at some foreign ham magazines. These, like "Radio Communication" from England and "Break In" from New Zealand, are the foreign amateur radio societies' equivalent of the ARRL publication QST.

The sections that make the most interesting reading are the advertisements, especially when the text is in a strange language. It seems that the Japanese are marketing their wares all over the world. There are plenty of advertisements for Yaesu and Trio (TR-22). Prices are such that the rigs are cheaper in some places than they are here in the USA. For example, a TR-22 costs the equivalent of about $160 in England, including taxes.

These FM rigs sold abroad usually come fitted with the most used frequencies for the local area, so anyone intending to buy a rig to take on a trip might consider getting one abroad, already crystalled up for use, and then pick up crystals for the USA when they get back. The rigs come set up for 220V so a slight modification will have to be made upon returning to the USA. If you do decide to buy a rig abroad it would be advisable to arrange it beforehand with a store so that one will be available. There is nothing like going into a store and being told, "We'll have one in two weeks," when on a three-day visit. I have access to magazines from a number of countries and can possibly help out with copies of advertisements if anyone is interested (SASE please). I only have the ads – I know nothing about the stores.

If you intend to visit the locals when abroad, be sure to fill your pockets with goodies like $1.00 bargain packs, IC's, (particularly linear IC's – LM 370, CA 3028, MC 1496, etc.) You wouldn't believe what they cost abroad.

Consider the Yaesu FT-101. In the U.S. it costs about $560, in England it costs about the same in English pounds. Not much difference, is there? Well, consider this: When I came to the USA I would have had to save, say, two weeks' salary to buy an FT-101. In England I would have had to save two months salary to get the FT-101. That is just one case. In general salaries in the U.S. are two to four times as much as they are in Europe in terms of actual currency. If that DX station says that he is using Drake, Collins or Yaesu gear, it probably cost him two to four times what it would have cost you in terms of "hours worked" to save up to pay for the rig. How would you like to have to pay $1500 for an FT-101?

On an item like the FT-101 the currency was equivalent, but consider an IC that costs 25¢ here. In Europe it may cost 50¢ (current equivalent), so in terms of "hours worked" that would cost the equivalent of $2.00.

Thus these goodies that you bring with you as gifts will be well received by the local homebrewers. These things are small, do not take up much space and may be tucked away in any convenient space.

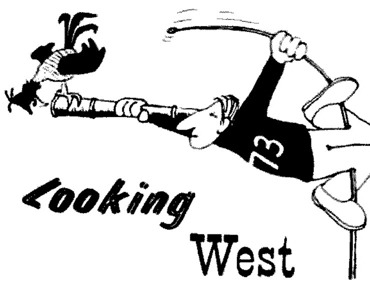
Another useful thing to carry is a supply of mint U.S. twenty-one cent postage stamps. These will allow overseas amateurs to send SASE's to stateside QSL managers at minimal cost, because the air mail postage can be prepaid by those stamps.

The minimum rate for an air letter is roughly the same in all countries. There is an international agreement in effect between the countries in the UPU. If I want to send a QSL to any overseas ham and prepay the airmail postage, I have to send him three IRC's at about 22¢ each. The DX station operator gets three surface rate stamps for those IRC's which just about pays for the minimum air rate. So I spend 66¢ to prepay one air letter costing about 25¢. I'd feel much better if I could get a foreign stamp at about face value instead of all those IRC's. If you pass out 21¢ stamps overseas you will be bringing a useful gift. Any non-DX'ers could always mount them in a stamp album. You don't have to just take 21¢ air stamps – mixed commemoratives would be just as welcome.

A stamp exchange of mint foreign issues at face or near face value (say 28¢ a stamp) would be a useful thing to set up in this country. The Ex-G Club (a club made up of Britons and spouses of Britons domiciled outside the United Kingdom) is starting up such an operation for their members.

Perhaps someone reading these lines is also a stamp dealer. If you are, here is a way of unloading your surplus stock. Think about it . . . you could make a profit *and* your customers would save by the difference between your charges and the cost of the IRC's. Everyone would come out on top except for the UPU and it serves them right for overcharging for IRC's!

G3ZCZ/W3

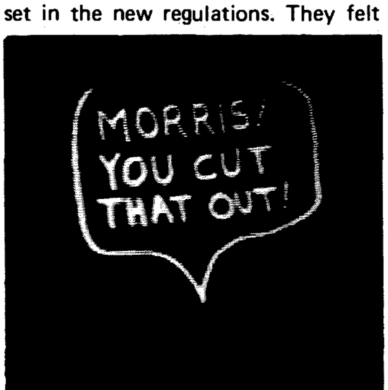


Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

At this time about the most important news out of this area concerns the recent FCC inspection of the Phoenix 34–94 repeater, under the new regulations. In a talk given February 3rd at the California Amateur Relay Council, Bob K7VOR of the Phoenix Repeater group explained how the situation began, and what has transpired since. According to Bob, this was *not a* planned inspection, but more a matter of coincidence. The FCC men were at the site on matters not related to amateur radio. (As with many other repeaters, this machine was located at a commercial broadcast site.) A chance meeting between two of the club members who were doing maintenance on the machine and the FCC personnel led to the inspection.

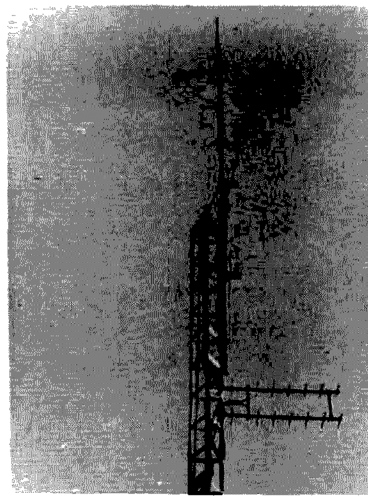
As an outcome of this inspection, the repeater was found to be in violation of the regulations regarding control. The inspectors apparently felt the system used (a timed carrier on 450 MHz) to control the two meter machine, did not meet the standards set in the new regulations. They felt this type of control without any form of tone coding could not be accepted as positive control. However, though they have been informed that there was a violation of the regulations, as of this date they have not received an official citation from the FCC (I called Bob this evening and this is where the matter stands as of 2/8/73.)

In the meantime, all repeaters in the Phoenix area are off the air and only operate when there is positive control (i.e., operator on duty). At the time of the meeting, 34–94 in Phoenix was down, since Bob was not there to control it himself. I sincerely hope this is *not* a trend that the rest of the country will be forced to follow. Phoenix neeos our support and backing, since it is apparent the FCC has decided on literal enforcement of the new rules. If this is true, then all repeaters will eventually be forced into a position of restricted operation. When I drove cross-country in some bad weather last October, having the rig in the car was quite reassuring to me. I was just about always within range of a two meter repeater, day and night.



Burt K6OQK doing maintenance on WA6TDD.

If the new repeater regulations force owners to curtail or restrict operating time due to the provisions on monitoring and control, then we will all be losers. I, like others, have come to depend on repeaters to communicate in time of emergency, as well as a place to chew the fat. I wouldn't like to be stuck some place deserted, only to find that the repeater I might be able to reach for help was off the air because no one was around to monitor and control it. Would you? My thanks to Bob WA6JGW and Chris WB6HGW for tape recording the meeting while Sharon and I battled the London Flu.



Transmit and 450 control antenna system of WA6TDD.

Since I became involved in FM a few years ago I, like many of you, had this dream of putting my own repeater high on some mountain. The closest I came was helping establish WA2ZWP on the Williamsburg Bank Building in Brooklyn. Well, it wasn't a mountain, but at least I did get a chance to fulfill part of my desire. I think that's why I was so enthusiastic about accepting an invitation from Burt Weiner K6OQK to drive up Mt. Wilson and visit the WA6TDD repeater site. WA6TTD is the only non-standard channel allocation in the L.A. area. Though the published input is 147.42, the input is actually split at 147.435 FM and 147.405 AM. The output is 146.40, FM. Though this is an odd combination of frequencies, Burt took the time to make the reason for it being this way clear. Simply, Mt. Wilson is not only the home of WA6TDD, but just about every major commercial broadcaster (TV and FM) serving the L.A. market. After years of trial, Burt found he had to keep his output at 146.40 to avoid any unwanted mixing and intermod with other services on the mountain. This output, coupled with a 145.195 input, worked fine until the new regulations forced TDD to move its input to where it is now. As to the AM input, retaining it was a decision that was left to the users of TDD, and they decided it would be in the best interest to keep it. Why? Well, while AM is slowly phasing itself out in most parts of the country, it is far from extinction out here. Most of the time I find it as easy to get an AM QSO as it is to get one through an FM repeater. An AM input affords the guy who has no FM equipment a chance to get involved in FM repeater operation and its benefits. At least that's my feeling. At the moment the AM input is out of service, but Burt tells me that it will go on again soon.

The system uses Motorola Sensicon A Receivers with a compression amp before the transmitter that keeps the output deviation at a stable 5 kHz even on under-deviated signals. Antennas are a pair of J poles with about 80 feet vertical separation. All this, combined with a site some 6700 feet above sea level, makes for better than average coverage. Oh yes, as an added bonus the view from atop Mt. Wilson is something to behold, even on a cloudy day. Come see for yourself.

. . .WA2HVK/6

FCC NEWS

Petition: To allow the use of topographic maps having the scale of 1:250,000, but having contour intervals of other than 50 feet, in applications for repeater stations in the Amateur Radio Service.

It is hereby requested that section 97.41(f)(1) be amended to read:

Location of the station transmitting antenna, drawn upon a topographic map having the scale of 1:250,000.

It was the intent of the Commission in section 97.41(f)(1) that applicants for repeater stations in the Amateur Radio Service use the maps sold by the U.S. Geological Survey, of the scale 1:250,000. These maps are available with a contour interval of 50 feet for the portions of the country with relatively flat terrain; however, these maps do not have a contour interval of 50 feet for portions of the country with mountainous terrain. Since it appears to be extremely impractical to obtain maps that comply with 97.41(f)(1) for many portions of the country, and it does not appear to be contrary to the intent of the Commis sion, I request that this petition be approved.

Respectfully submitted,
Robert R. Rule
licensee: WA7EGK
P.O. Box 1054
Laramie, Wyoming 92070
Telephone: 307-742-3369
January 5, 1973

BYKW DVNQBMTVJL KW MHON J EKFCVWKMH – JQVKO RMMO. NMX YJFC JOVCJEN WMOFCE BYC VCJO LCWWJTC.

WORKED ALL BRITAIN CONTEST

The WAB phone contest will be held April 1, 1973, and WAB CW contest will follow the next Sunday. Times are between 0900–1200 GMT. Score 5 points for each contact. Operation on 160, 80 and 40m. Scoring multipliers are the number of different WAB areas worked. Exchange RST and Nr. Logs should be mailed within 50 days to WAB Contest Mgr., G2DSF, Norman Booth, 49 Baggrave St., Leicester, England.

5TH RTTY WAE DX CONTEST

The Deutscher Amateur Radio Club (DARC), has the honor to invite RTTY amateurs all over the world to participate in the 5th RTTY WAE DX Contest. Contest period is Apr. 28, 0000 GMT – Apr. 29, 2400 GMT. Call CQ WAE de . . . on all bands 3.5 through 28 MHz. Exchange QSO-Nr. & RST. Certificates to the highest scorer will be awarded. Logs must contain bands, exchanges sent and received, call signs, QTCs sent and received, points, multiplier. Use a separate log for each band. Enclose a summary sheet showing the scoring, rest period, classification, your name and address in BLOCK LETTERS. The deadline is June 10, 1973. Mailing address: WAEDC-Committee, D9-8950 Kaufbeuren, Postbox 262, West Germany.

DAYTON

The 22nd Annual Dayton Hamvention will be held Saturday, April 28, 1973, at the Dayton Hara Arena. Technical forums, exhibits, flea market and 450 MHz transmitter hunt. For information write: Dayton Hamvention, Box 44, Dayton OH 45401.

AUTHOR'S CORRECTION

K2OAW's Solid State Repeater Control in the March issue contained an error in Fig. 1 on page 36. Connections to pins 4 and 7 of the 741C were inadvertently reversed. The corrected portion of this circuit is shown below.

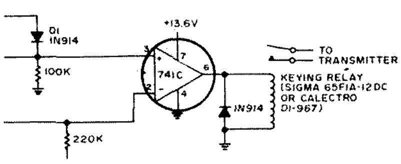


Fig. 1. Simple COR and timeout timer.

FLORIDA QSO PARTY

FLORIDA SKIP, the all Florida Amateur Radio Publication, is happy to announce the 9th annual FLORIDA QSO PARTY to be held April 7th and 8th, 1973. All amateurs are invited to participate. Florida amateurs are urged to work as many out-of-state stations as possible as well as those within the state. Contest periods: Sat., 1500–2000; Sun. 0000–0500, 1400–2359. All times GMT. Exchange: Florida stations: RST and county. Non-Florida: RST and state, province or country. Trophies will be awarded to high scoring stations. Contact FLORIDA SKIP, Contest Chairman, P.O. Box 501, Miami Springs FL 33166 for further information.

BIRMINGHAMFEST

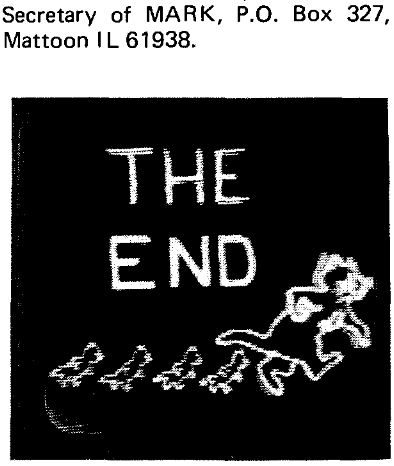
The BirmingHamfest Amateur Radio Convention will be held on May 5–6, 1973, at the Alabama State Fairgrounds Exhibition Hall in Birmingham AL. This event is sponsored by the Birmingham Amateur Radio Club, John A. Outland, WB4PJU, President. Those wishing to attend or exhibit can get information by writing to P.O. Box 603, Birmingham AL 35201.

LOWER COLUMBIA CELEBRATION

Lower Columbia Amateur Radio Assn. announces its 25th anniversary celebration – Dinner – April 14th 1973. Prizes, contests, program, swap shop, CW contest, etc. For information write WA7NRQ, 355 Baltimore, Longview, Wash. 98632. $3.25 per head.

MATTOON HAMFEST

The Moultrie Amateur Radio Klub of Mattoon IL will hold its 12th annual hamfest at the American Legion Pavilion in Wyman Park, Sullivan IL on 29 April. For further info write Robert Boyer WB9AAV, Secretary of MARK, P.O. Box 327, Mattoon IL 61938.



Thanks to John K3SLJ

IF YOU DON'T HAVE A MOUNTAIN

. . .there are other ways to get your repeater's antennas off the ground. Our cover photo this month shows intrepid alpinists Bill Stephens WBØCAB (in the tan coat) and Richard K. Brown WØEMU installing the feedline to one of two Cushcraft antennas for the WØEMU 16–76 repeater in Winfield, Kansas, at the 600 foot level of a commercial tower. The tower looks high enough in the groundhog's view at the left. . .but it must have tripled in height by the time the photographer swung out on the rigging at the top to take the cover shot.

The photo above shows WØEMU assembling the Cushcraft antenna and, below, WBØCAB and WØEMU are readying the coax for the long haul uphill.

..... Social Events continued from p. 17.

RALEIGH HAMFEST

The Raleigh NC Amateur Radio Society will hold their first annually scheduled hamfest on Sunday, April 15th, at Dorton Arena (indoors) on the State Fairgrounds in Raleigh. Indoor flea market, meetings (MARS, DX, FM, NETS), YL/XYL program, and prizes. Talk-ins Saturday night and Sunday morning on 3923 kHz and on 146.94 simplex, 146.28/146.88, and 146.04/146.64. Overnight camper parking available for $2.00. For info write RARS Hamfest, P.O. Box 17124, Raleigh NC 27609.

ROCK RIVER HAMFEST

The 7th annual Rock River Radio Club Hamfest will be held on Sunday, April 8, 1973 at the Lee County 4-H Center in Amboy IL. Advance ticket price is $1.50 and gate price is $2.00. Prizes – free coffee and donuts from 9–10 a.m. – indoor facilities. Talk-in will be on .94. Note: Absolutely no fire arms permitted!! Tickets are available from Carl Karlson W9ECF, Box 99, Nachusa IL 61057.

ONTARIO CENTENNIAL STATION

The Burlington Amateur Radio Club VE3RAB is celebrating the centennial of the Town of Burlington, Ontario, by operating a centennial station for the duration of the 1973 year. The special call sign of VA3RAB will be used and acknowledgement of contacts will be with a colorful 3 section folding QSL card. Operation during all major contests will be part of VA3RAB activity.

ROCKAWAY AUCTION

The Rockaway Amateur Radio Club will hold their Annual Spring Auction and FMers Get-Together on Friday evening, April 27th, at 8 p.m. Location will be Hall of Science Building, World's Fair Grounds, Flushing Meadow Park, Queens NY. Auction will be open for amateur radio gear. Doors open at 6 p.m. For further info write RARC Auction Committee, P.O. Box 341, Lynbrook NY 11563.

JOHNSON CITY HAMFEST

The Fourteenth Annual Hamfest, sponsored by the Southern Tier Amateur Radio Clubs, is scheduled for 2:00 PM, April 14, 1973, at St. John's Ukranian Hall, Johnson City, New York. Admission to lectures and flea market is free; awards and excellent dinner held to $5.00. For tickets or further information, write STARC, P.O. Box 11, Endicott NY 13760. Advance ticket sales only by April 11, 1973.

B.A.R.K. S.W.A.P.

The New Jersey Bergenfield Amateur Radio Klub's annual SWAP & SELL Sunday April 8, 1973, Bergenfield Recreation Center, Legion Drive, Bergenfield, N.J. For further information write Robert Winter WA2DZE, Bergenfield Amateur Radio Klub, 57 Clinton Park Drive, Bergenfield NJ 07621. Call 384-3232 9 a.m.–6 p.m.

BALTIMORE HAMBOREE

The Greater Baltimore Hamboree will be held Sunday, April 8, 1973, at 10 AM at Calvert Hall College, Putty Hill and Goucher Boulevard, Towson MD (1 mile south of Exit 28 Beltway–Interstate 695), food service, flea market, prizes, REGISTRATION $2.00. No table charge or percentage. Info: Joe Lochte, 5400 Roland Ave., Baltimore MD 21210.

DEKALB HAMFEST

The Kishwaukee Amateur Radio Club of DeKalb, Illinois is having a hamfest on May 6, 1973, 8:00 AM–3:00 PM. Location is the Notre Dame Center, indoors, 3 miles south of DeKalb off Rte 23 – signs posted. Admission is $2.00 at the door, $1.50 advance sale. For details write Box 473, DeKalb IL 60115. Talk-in will be on 146.94 and 52 simplex, 13–73 and 7258 kHz.

SHARON MA AUCTION

The Sharon Amateur Radio Association is planning an auction on the 29th of April 1973. It will be held at the home of David Fisher WA1LXE, 30 Ames Court, Sharon, Mass. Free coffee and donuts will be served! The auction will begin at 1:00 p.m. For information, please contact Robert Linsky WN1OWI, 21 Harold St., Sharon MA 02067.

MARYLAND-POTOMAC HAMFEST

The Maryiand-Potomas Area Hamfest will be held at Westminster, Sunday, April 29th, 9:00 to 5:00. Registration of $2.00 also includes flea market or tail-gate sales. Professional food and beverage catering. Parking for 400 cars. All customary hamfest events. Information from K3DUA or K4LHB per Callbook address. Talk-in on 146.94.

LICENSE FEES

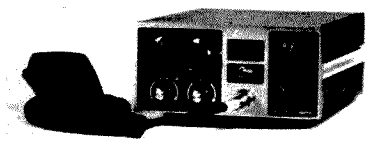
Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

NEW PRODUCTS

CLEGG 27B



When the Commission pulled the wraps off the 147 MHz segment of the FM band, the Clegg 27A was suddenly in need of a transmitting ability for this meg. It could already receive on either the 146 or 147 meg segments of the band, so there was no problem there.

The addition of one more crystal for the transmitter fixed the problem and presto: complete coverage of the entire two megs, transmit and receive. Onwers of the A model can get info from Clegg on adding that extra crystal, which is simple.

The question that comes to a great many minds is this: why spend 490 clams for an FM rig when you can get one for half that which does pretty well? It is ever the question of price vs perfection. Why buy a Rolls when a VW will get you there?

If you live in a one repeater locality (does anyone live in a one repeater locality?) you don't need to worry much about saving money on crystals. Of course if you ever travel out of your area that is a different horse color. But if you live or visit some place like New York, New England, or even California, then you will begin to scratch your head over the crystal problem unless your name happens to be Valpey or Fisher.

Take New England, for an example – you need crystals for just about every 146 and 147 meg pair, plus some for the weirdos – a total of about thirty pairs of crystals if you want to be able to hit everything. That's sixty crystals. At $3.75 each, you have blown $225. Around New York you'll probably need even more, with about 35 pairs being par for the course. Ditto California. When you add in $200 for crystals to the price of a rig, the 27B begins to appear to be much more of a bargain.

When you consider that even with that big handful of crystals, you can't come close to hitting all the channels that you can with the 27B, the economy grows ever clearer.

Continued on p. 114 .....

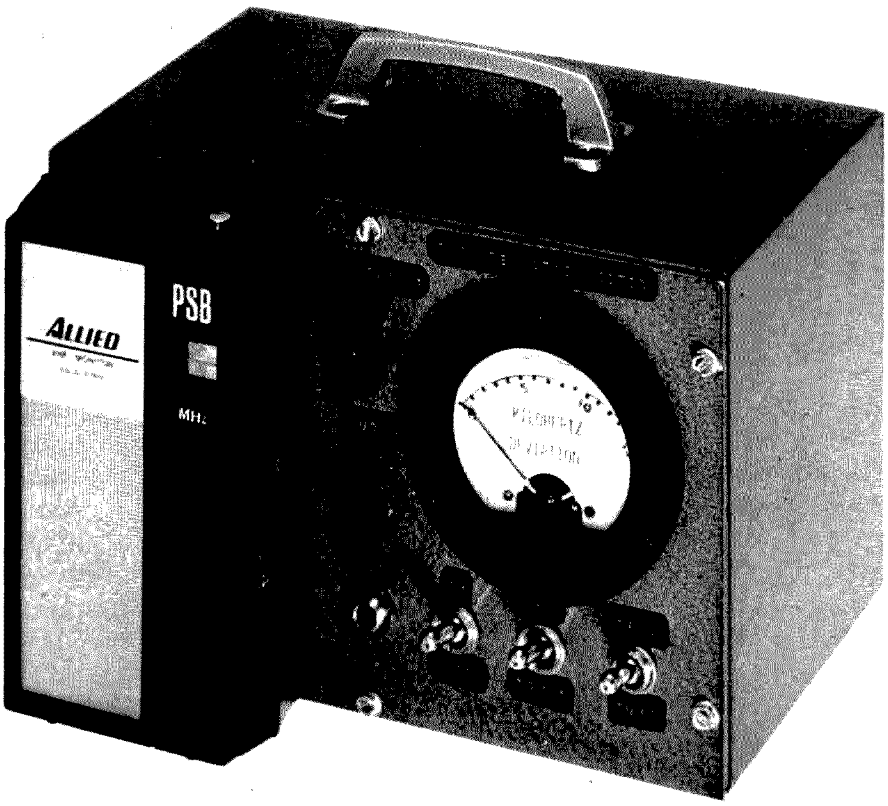
Burton H. Syverson W9HD
2050 Coral Ave.
Aurora IL 60506

LOW COST FM DEVIATION METER

Most electronic experimenters have a lot in common. They like to own test gear, have limited funds, like to be original and have a hard time finishing one project before their mind wanders off to a new one. Another thing is that they may not really need the piece of gear they set out to build. Nevertheless, the junk box is usually raided (along with the bank account) and the curiosity is generally satisfied. With this kind of background it is little wonder that I set out to build an FM deviation meter without even owning an FM rig. The fascination provided by exploring different possibilities of design at minimum cost presented too much temptation to resist. The result of this madness is the following unit, a lot of lost sleep and a few more gray hairs.

The search for a low cost FM deviation meter started with the idea that the low cost hand held Public Service Band receivers might offer an approach to the problem. The possibility of easily retuning those 30 to 50 MHz and 146 to 175 MHz receivers to 6 and 2 meters evoked promise. Another possibility was by tuning to the frequencies of the multiplier stages of 220 and 450 MHz transmitters, frequency deviation at their output could be determined by multiplying the value by the same amount the signal would be multiplied in the transmitter.

Investigation showed that the 10.7 MHz i-f discriminator output voltage change was very small (as expected). In addition, the 1:1 receiver dial would make it hard to center the received signal at the crossover point of



The deviation meter makes a neat portable package that is an invaluable aid to anyone on FM.

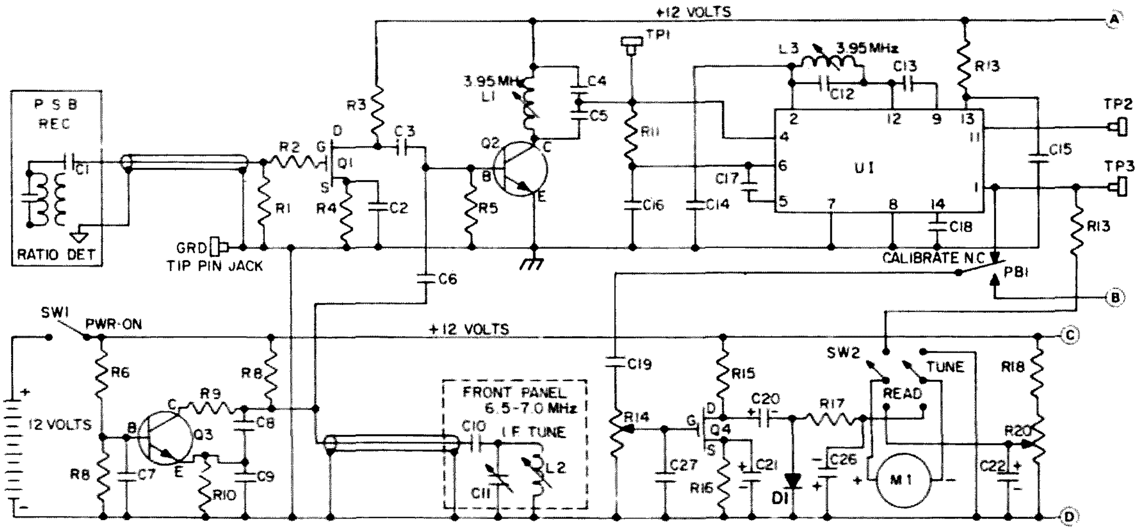


Fig. 1. Schematic of the deviation meter.

the ratio detector. This is important in order to get repetitive results. Even though the transmitter to be checked would be close by, the possibility exists that another nearby transmitter could upset the output of the ratio detector and upset the reading. The decision to add another tuneable converter after the 10.7 MHz i-f solved some problems with the following results:

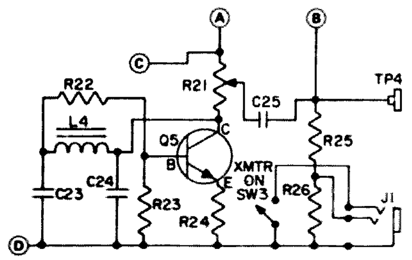
1. Difficulty in tuning the signal was eliminated. Any signal heard through the receiver is heterodyned down to the 3.95 MHz range. The conversion oscillator tuning rate is much better.
2. Other signals which might appear in the 10.7 MHz range are attenuated.
3. By using an intermediate frequency inside an amateur band, the calibration is easier.
4. The output voltage per kHz deviation is much greater.

For the unit in Fig. 1, a 146 to 175 MHz P.S.B. receiver (usually found at hamfests) was used. The 10.7 MHz i-f signal is tapped off the primary winding of the ratio detector transformer through a small coupling capacitor and shielded lead. Due to the very small coupling capacitor the de-tuning effect is minimal. The signal is amplified by transistor Q1. Its purpose is to regain some of the signal lost by the capacitive voltage divider action of C1 and the shielded lead capacitance. In addition, it helps to isolate the vfo from the receiver and furnishes a low impedance source for mixer stage Q2. The vfo tuning range is 6.5 to 7.0 MHz to heterodyne the incoming 10.7 MHz signals to 3.950 MHz. The ULN2111A integrated circuit is a combination limiter amplifier and quadrature detector operating at 3.95 MHz. Transistor Q4 functions as an ac amplifier for driving the rectifier and meter circuit. Control R20 is used to provide a small forward bias voltage for D1. This greatly improves the linearity of the meter at the low end of its scale. Transistor Q5 functions as a 1 kHz audio oscillator. Its output is used to modulate the transmitter requiring adjustment. It is also helpful for checking the ac voltmeter section or whenever a low level 1 kHz signal is needed. The whole unit is powered by 8 C cell flashlight batteries. The current drain is approximately 30 mA. Smaller batteries may be used.

When using the meter it is only necessary to tune the signal on the receiver until it is heard in the speaker. Next, vary C11 (i-f tuning) and center the signal with meter M1 in the center of the "S" curve (see Fig. 3) with SW3 in the "tune" position. Switch SW3 to "read." By using the audio from jack J1 to modulate the transmitter, the clipping level may be read.

Construction

The unit is built in a 6 x 9 x 5 in. Bud utility cabinet fitted with rubber feet and a carrying handle. The receiver is bolted to the front panel. The receiver can be removed for servicing by unsnapping it from its case. Black plastic tape around the seam of the



PARTS LIST

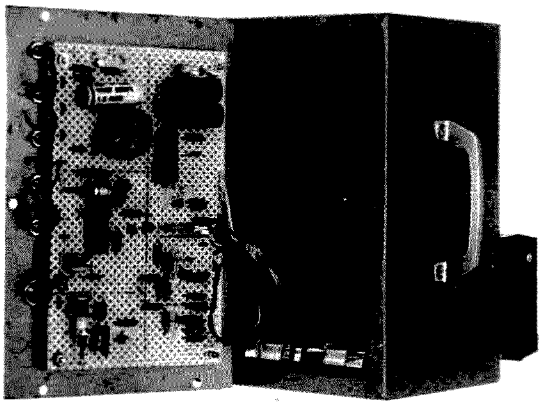
R1, 13	100K
R2	100Ω
R3	1K
R4	150Ω
R5	47K
R6, 16, 17, 18	4.7K
R7, 8	1.5K
R9	27Ω
R11, 12, 23	330Ω
R12	47Ω
R14	1M pot.
R15, 24	10K
R20	1K pot.
R21	2K pot.
R22	2.2K
R25	470Ω
C1	10 pF
C2, 17	.01 μF
C3, 6, 10	50 pF
C4	1000 pF mica
C5, 8	250 pF mica
C9	470 pF mica
C11	100 pF variable
C12	200 pF mica
C13	4.7 pF
C7, 14, 15, 16, 17, 19	.1 μF
C20	10 μF 25V
C21, 23, 25	.47 μF 25V
C22, 26	100 μF 25V
C24	1 μF 25V non polarized
C27	100 pF
D1	1N34A
Q1, 4	HEP 802
Q2, 3, 5	2N706
L1, 3	40T no. 34 3/8" diameter (Miller 4406)
L2	22T no. 26 3/8" diameter (Miller 4405)
L4	88 mH toroid
SW1, 3	SPST toggle
SW2	DPDT toggle
M1	0–100 μA
U1	ULN2111A IC (Sprague)
GND	Black tip jack
TP1–4	Red tip jacks
PB1	N.C. pushbutton
J1	3 circuit jack

case prevents the receiver from accidentally coming apart. Prior to mounting the receiver to the front panel, the i-f output lead should be installed. This consists of capacitor C1 connected at the top of the primary winding of the 10.7 MHz ratio detector transformer. The opposite side of C1 connects to the center of a length of very small diameter shielded wire or coax. The shield is connected to the circuit ground in the receiver. Having a schematic of the receiver will help you locate the correct point at which to connect C1. Lacking this, it is possible to determine the correct point by using an rf probe or high frequency scope with a low capacity probe. Look for the point of highest signal level at the last i-f transformer when tuned to a nearby transmitter. Check that the signal disappears when the transmitter is turned off. Also check for dc collector voltage at this point to make sure you have the primary and not the secondary or tertiary winding of the ratio detector transformer. Drill a hole through the rear cover of the receiver just large enough to clear the small shielded lead. Control R21 and capacitor C11 are mounted to the front panel. All other controls are of the screw driver adjusted type and mounted on the circuit board. The meter, jack J1 and switches SW1, 2, and 3 are the only other components fastened to the front panel. Not having the patience to design PC boards, the circuit was built on vector board. The only precautions are that shielded leads should be only as long as necessary and that L1 and L3 be separated to reduce any tendency for the IC to oscillate.

Testing and Alignment

Prior to applying power to the unit it is wise to check for shorts with the integrated circuit unplugged. Operate the power switch. Connect the common lead of an oscilloscope to the ground jack and TP4 to the vertical input lead. The output of the 1 kHz oscillator should be viewed when the audio control (R21) is advanced. Return the control to zero output.

In order to calibrate the meter it is necessary to make a new scale. At this point it must be decided what the maximum deviation will be. Should indications in



The circuit board is mounted on the back panel of the cabinet with the test jacks along the top.

excess of 15 kHz be desired, it will be necessary to check the linearity of the particular quadrature detector. This is good to do in any case. To increase the linearity it will be necessary to empirically shunt L3 with high values of resistance until the desired linearity is achieved. In my case I chose 15 kHz because the linearity is very good and most transmitters are adjusted to deviations within this range. With the deviation being proportional to the output voltage shift of the IC, it is only necessary to calibrate the meter as an ac voltmeter. This is done by feeding a known signal into the Q4 ac amplifier with SW2 in the read position. Before introducing the signal set control R20. (This is done by setting R14 toward its ground end. Slowly advance R20 until there is a barely perceptible movement off of mechanical zero.) Monitor the input of Q4 with an oscilloscope (or other suitable means). Use TP3 with an external oscillator at 1 kHz or TP4 with the calibrate push button held down, to introduce signal. Introduce a suitable signal (up to 2V peak to peak) as monitored on the scope. Set the scope gain so the signal occupies the same number of divisions on the scope as kHz you wish to indicate. Advance control R14 until the meter indicates full scale. By reducing the oscillator output and noting the scope readings, intermediate points on the scale may be calibrated. Next set the vfo to frequency by tuning a 40m receiver to 7.0 MHz. Set the oscillator capacitor C11 to approximately one quarter meshed. Tune inductor L2 until the vfo is heard in the receiver.

In subsequent tests a 75m transmitter connected to a dummy load may be used as a signal source. An unmodulated rf generator may also be used. In the latter case, the introduction of signal to TP1 should be through a coupling capacitor. In either case the signal should always be maintained at the limiting level or above unless otherwise noted. When using the transmitter as a signal source, start with the drive control at minimum to avoid damage to the semiconductors. If you cannot get enough pickup with this method, attach a short radiator to the center lead of the coaxial cable feeding the dummy load. The 1 kHz oscillator output is adequate for setting the control R14 up to 20 kHz deviation on the meter. Should you desire the full-scale reading of the meter to read above this value, check at a lesser deviation (i.e., 5 kHz on the meter scale). If a wide band oscilloscope is to be used it may be necessary to bypass the input leads to keep rf patterns out.

Disable the vfo by shorting out capacitor C7. If the IC is not in its socket, temporarily remove power while it is installed. Set switch SW2 to the "tune" position. The meter should read approximately one-half scale. Connect a test lead or short piece of wire to TP1. Tune your transmitter up on 3.950 MHz in the CW mode so the output can be easily varied. Connect a VTVM with rf probe (or wideband oscilloscope) from the gnd jack and TP2. Using the lowest range on the VTVM, couple just enough energy from the transmitter to get a reading. Inductor L3 may now be tuned for maximum indication while keeping the input level below the limiting level of the IC. It will be noted that the meter in the unit behaves like a zero-

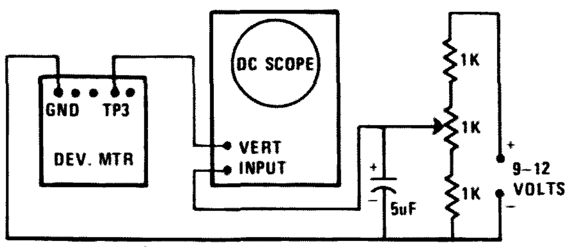


Fig. 2. Calibration circuit. Complete instructions are given in the text.

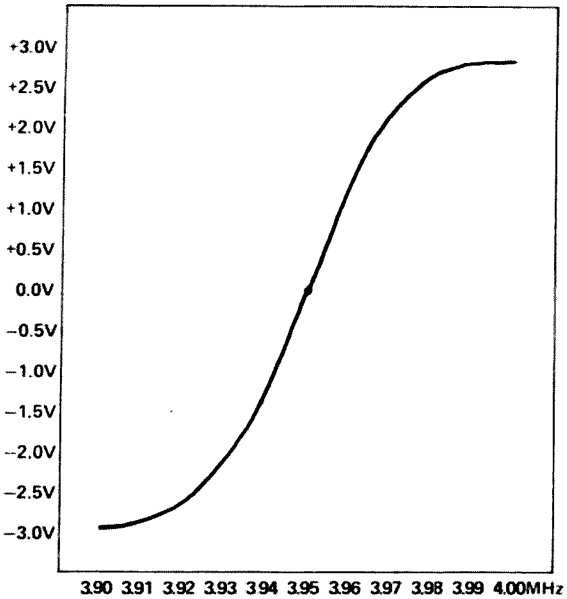


Fig. 3. Response curve of the quadrature detector without any resistance shunting coil L3. Zero voltage represents the quiescent state of the IC measured at TP3. This is the level to which all other points on the curve are referenced to.

center meter monitoring a discriminator "S" tuning characteristics. L3 should be tuned for the center of the "S" curve (same meter reading as before signal was introduced).

Remove the power and connect the test circuit shown in Fig. 2. The scope must have a dc vertical amplifier. Before applying the power again, set the oscilloscope trace to the zero line with the dc amplifier on and with no signal applied (transmitter on standby) operate the "power" and "read" switches of the deviation meter and apply power to the test circuit. The oscilloscope trace will probably move from the zero line. Return it by using the 1K potentiometer of the test circuit. Turn the transmitter on and slowly raise the output level until the rf voltmeter connected to TP2 indicates the limiting level has been reached. It may be necessary to retune L3 if the scope trace is not on the zero line. Vary the transmitter frequency above and below the center frequency the amount corresponding to the maximum frequency deviation you desire to read. It is desirable to set the scope vertical gain so this deviation moves the scope trace an even number of squares. Note the amount the trace moved. Without moving the scope vertical gain adjustment and switching to its ac amplifier, the trace should again move to the zero line. Turn the transmitter off. Move the scope lead to TP4 and adjust the audio output control R21 so the negative and positive peaks coincide with trace excursions just noted. Depress the calibrate pushbutton and adjust R14 to read the deviation. Should the audio level be insufficient, adjust for a lesser deviation such as setting the audio level to one-half of what is required and calibrating the meter to one-half of full scale. Release the calibrate push-button and set switch SW2 to tune position. The meter should read somewhere in its mid-range. As a further check, the transmitter output can again be increased to the limiting level. The meter needle should move above and below the center as the transmitter is moved above and below 3.950 MHz.

All that is left to do now is to peak L1 to 3.95 MHz. With the output of the transmitter reduced to zero, connect one end of a test lead to the junction of R1 and R2. Slowly increase the transmitter output to get an indication on the rf voltmeter connected to TP2. Peak inductor L1. You can now remove all connections. The meter should be oerational.

The term "calibrate" is a misnomer to some extent as the instrument does not contain a standard. However, if the value of signal was checked at TP4 with an ac VTVM and recorded when R14 was set, it should be easy to recheck M1 using the same ac VTVM (connected to TP4) calibrate pushbutton.

Conclusion

No doubt the design could be changed to provide such features as peak deviation indication (instantaneous peak indication may be viewed with a scope at TP3) but the original intent was to construct an adjusting tool, not a monitor. As with all projects there is a lot of hindsight and plenty of second guessing. The fact this particular mixer used functions as a noise generator gives rise to this kind of thinking. Even though this does not present a problem (as the meter is used only on strong signals), I cannot help wondering if a Mark II model is not in the offing.

. . .W9HD

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TAMING THOSE HOT 500MHz FETS FOR 2M FM

Working with high gain FET's on 2 meters can be a problem unless you know what to expect. K1CLL provides good working knowledge.

The RCA insulated and protected dual-gate metallic oxide semiconductor field effect transistor type 40841 is quite a device. I don't work for RCA but I am quite fond of their products as you can gather. This device has up to 32 dB gain as an rf amplifier at 44 MHz and is useful up to 500 MHz without neutralization. It also features a low noise figure.

In the course of using them in the rf and mixer stages of a two meter FM receiver recently (see *73*, December 1972) I encountered a few things which cannot fail to be of interest to the homebrewer. They were new to me, and I have lately turned the half century mark in my electronics experience.

In case you are not familiar with the 40841, here is some information: It is intended for use from dc to 500 MHz and has a wide dynamic range, which is good for busy channels crowded with loud signals and weak ones, and has low cross-modulation performance over the agc range, which is a good item if your neighbor has a KW. The gate no. 2 acts as a shield between gate no. 1 and the drain, similar to the screen grid effect in tubes, and helps eliminate the need for neutralizing. It requires negligible power for agc, its input impedance is high and is little affected by agc action and therefore the tuning doesn't change much. The back-to-back internal diodes clamp at about ten volts, protecting the gates and cutting off large noise transients too.

Their price is not what you might expect for all that performance, as they sell for under a buck in quantity!

You should probably order several when you buy, as they are only sample tested at that price, and you should then test them yourself. In spite of this, I have found no bad ones in about 50 so far. If you've got the money, buy 3N200's, which are a little better, and are all tested (but you'll have to pay four times as much). They are good for amplifiers, oscillators, mixers, video amps, dif-amps, frequency multipliers, and a lot more.

Figure 1 shows the rf amplifier in pictorial form in case you want to build a quickie. It will show a large gain right away, around 30 dB, or one thousand times in plain English. With reasonable bypassing, no self oscillation will occur at 147 MHz, and tuning will be good and straightforward. However, several small peculiarities were noted, one happening when C2 was operated quite a way from the 147 resonance point, a click being heard. Note that I like to measure, look, and listen to what goes on when I'm working on a new circuit. This takes an rf voltmeter, a small scope, an af amplifier, and a small speaker. It is well worth the trouble. Without listening, for example, this little demon wouldn't have shown up until later – probably the first time you turned it on after installing it all in

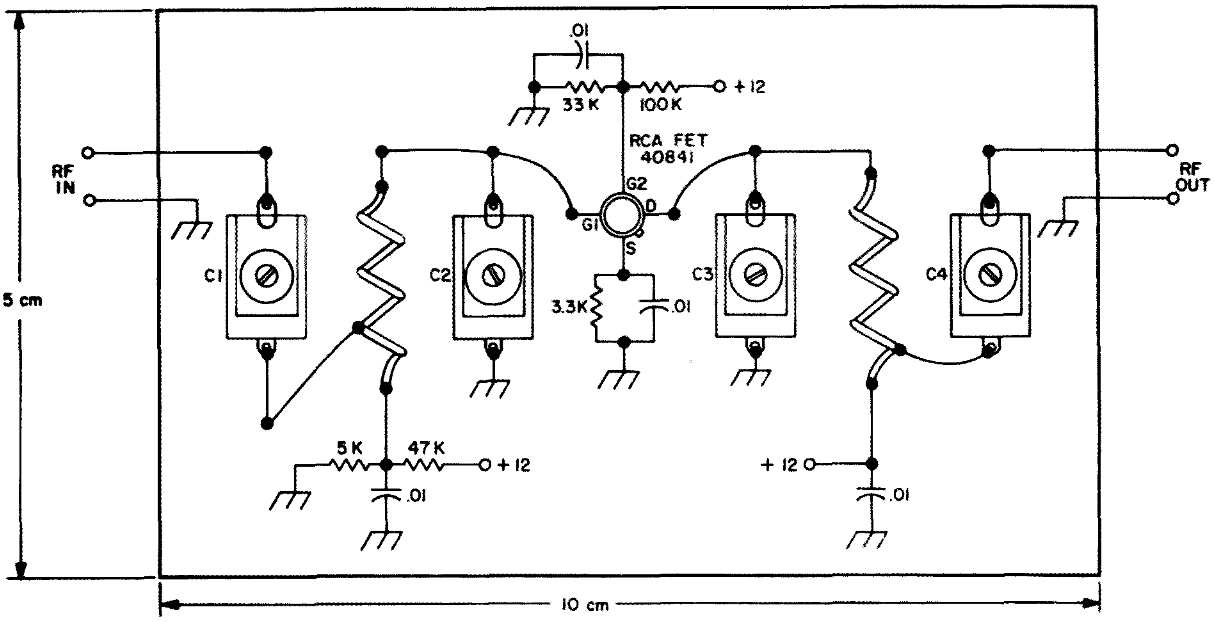

Fig. 1. Top view of the rf amplifier assembled on a copper-clad circuit board. L1 and L2 are 5 turns No. 18, 2 cm long, 1 cm diam., tapped at 1½ turns from cold end. Note: When installing C2 and C3, position adjusting screw at ground side. All trimmers 1–12 pF, ARCO 420.

a metal cabinet! Using these three facilities it was found that the "click" was in reality 600 MHz power being detected by L.O. harmonics as it swept by. UHF oscillation causes nasty things to happen. Your rf stage and mixer become noisy and unreliable and your i-f tuning meter takes off. This is very difficult to find and trouble-shoot, but well worthwhile getting rid of. You see, if you want really good filtering action, *for* 147 and ***against*** other frequencies, you should tune L1 and L2 to 147 in good style, which is done with C2 and C3. Elementary, of course, but then what happens? The same thing that I have seen in a good af amplifier, which oscillated at 200 MHz, and in my Gonset Communicator 3, which – brand new and straight from the factory – had 500 MHz oscillation in the plate circuit of the cascode stage. I cured that one with a 1 pF capacitor. Remember tubes? In this case C2 and C3 resonated the FET to 600 MHz, with L1 and L2 merely acting as rf chokes. This action was not easy to cure, and it took me most of a weekend, so I'm passing the dope on to you hoping it will save you time and trouble. If it gave me a headache after fifty years of electronics, I defy a newcomer to lick it easily, except maybe by luck, or compromise, which is not good.

After replacing the 147 MHz tuned diode detector testing unit I was using with a 400 to 600 MHz one, sure enough, lots of 600 MHz power was found. A zero to ten mA meter was put in the drain circuit and showed a rise from 8 mA up to 9.5 mA when watched carefully. I was pushing the mils to make the trouble show up more. Normally around 4 to 5 mils of current is used. With various sized small metallic probes, the short grounded portions of C2 and C3 were found to be very touchy at 600 MHz, a sure confirmation of UHF power being present. Unwanted in this case, to say the least.

You may have seen commercial circuits with a three hundred ohm resistor in the collector line going to the tuned circuit. This may stop spurious, but does that satisfy

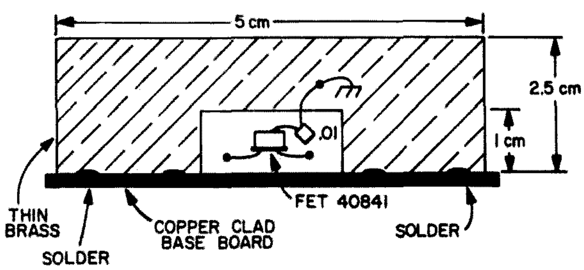

Fig. 2. Side view of the rf stage after the shield has been added.

you? If so, read no further. If you want to know the real dope, read on. It finally boiled down to the same old story, only more so. The source, which is the FET element corresponding to the emitter of an old fashioned bipolar transistor, or the cathode in days of yore, simply needed a lot more *careful* UHF bypassing, and C2 and C3 needed a little shielding from each other. A thin brass sheet ridged over the FET output lead (drain), as shown in Fig. 2, kept C2 from receiving feedback from C3. A small bypass (.01) was then soldered to the case of the FET and connected to the shield, as shown in Figs. 2 and 3. That was it! Luckily the FET is made mostly of silicon and also that the case is internally connected to the source. You can use a small homemade clamp, solder the .01 to it first, then put it on the case of the FET if you're the ultra-careful type. No UHF oscillation has been found since then in these amplifiers. On 147 there has never been any, so you are left with a good stable unit.

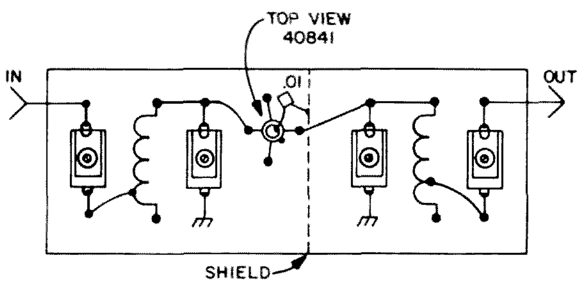

Fig. 3. Top view of the rf stage indicating the position of the shield and the .01 bypass.

Again, note that this effect is a particularly treacherous one. It does not show up on 147 as oscillation, but renders life miserable through its side effects of noise and on the i-f performance. There is an odd tunable rise on the tuning meter, excess noise, and BFO-like sounds in the output.

With two stages of this "battened-down" rf, the gain is terrific at 147 MHz, perhaps more than you may need. Just put in one of those little square trim pots (500 ohms or 1K) in the source lead and you can live happily with everything quiet, band-filtering action of 5 good tuned circuits on 147 MHz, and controlled rf gain.

. . .K1CLL

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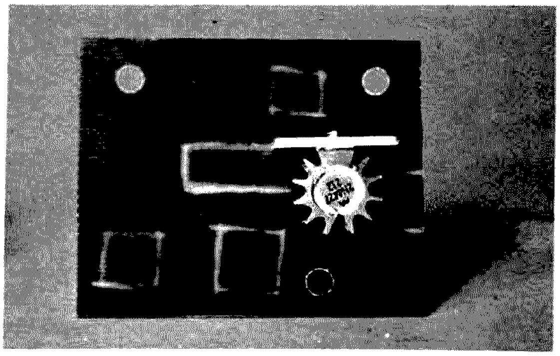
TWO MORE TWO METER AMPLIFIERS

In the December issue of *73*, I described an amplifier that would deliver 25 watts output when driven with 5 to 7 watts. In this article, I am presenting two more inexpensive amplifiers that, when used together, can take 100 milliwatts and amplify it to about 7 watts – enough to drive the 25 watt amplifier. If you want, you can eliminate the first stage and get 25 watts output when driving the last two stages with a 1 watt rig, such as the TR-22. All of the three amplifiers are suitable for loading into a 52 ohm antenna or another amplifier, so you have several options that you can take, depending on available drive and desired output.

Amplifier No. 1 is easy and very inexpensive to build. It takes 60 to 120 milliwatts and puts out from 1 to 1.6 watts. Be sure to keep the drive from exceeding 120 milliwatts. I built mine on a piece of single sided glass epoxy board. All parts go on the copper side except for Q, which mounts flat



Bottom of the 1 watt amplifier showing the transistor and its heat sink.

against the other side with its heat sink. I used a HEP 502 heat sink. It kept the transistor cool enough after two hours operation, but I added a small strip of aluminum to be extra sure. The 2N4427 is a very rugged device, and is used as a driver in the HR-2, RMV, and several other transmitters. I must admit that I used some ideas from W9ZTK's article in the July issue of *73*

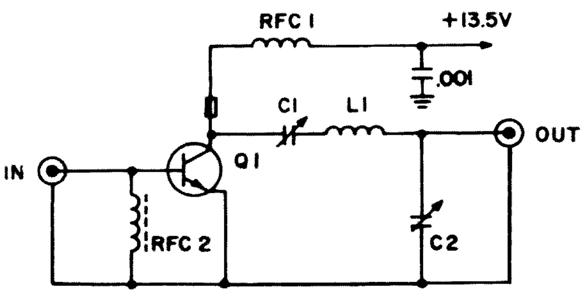
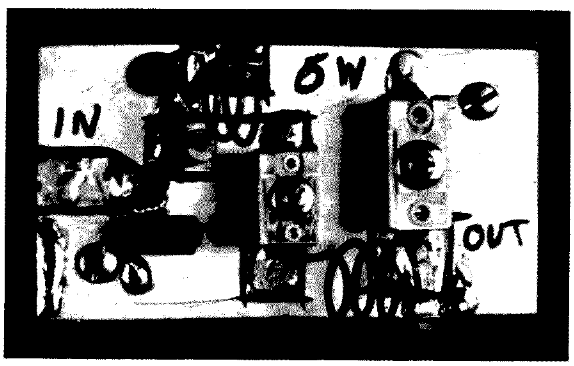


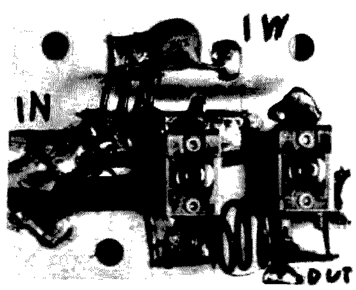
Fig. 1. Schematic diagram for both the 1 watt and 6 watt amplifiers. Refer to the respective parts lists for values.



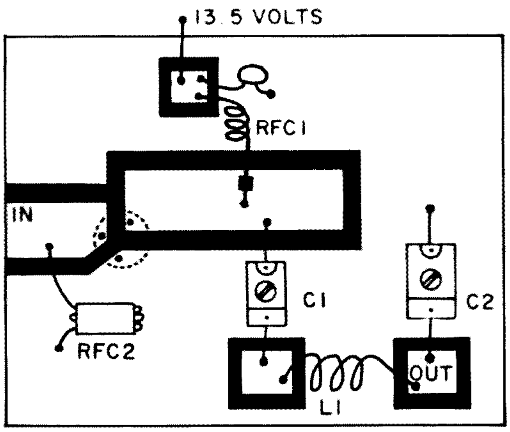
Top view of the 6 watt amplifier.

for part of the layout. The 2N4427 stage, when properly tuned, should give at least 10 dB of gain – which turned out to be a little better than the 2N3866 I tried.

Amplifier No. 2 is almost identical except for only two circuit changes. One is a slightly larger loading capacitor (which



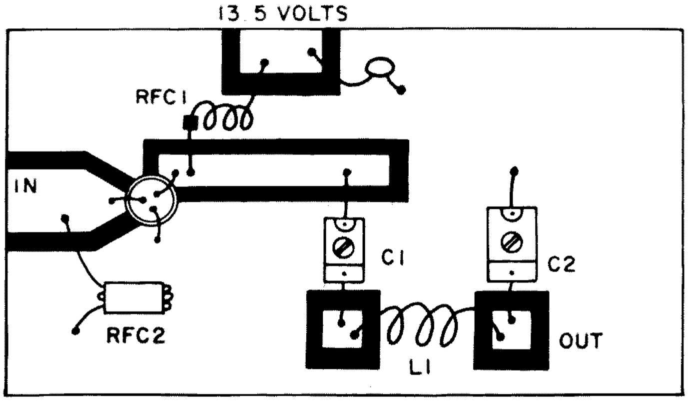
Top view of the 1 watt amplifier.



PARTS LIST 100 mW-1W AMP

Q1 – 2N4427
L1 – 3½T no. 18, 0.7 cm I.D., 1.5 cm long
C1,2 – 4–40 pF (ARCO 403)
RFC$_1$ – 2½T no. 18, 0.7 cm I.D., plus ferrite bead
RFC$_2$ – 3T inside 6 hole 200 MHz ferrite bead

Fig. 2. Full size PC board layout (copper side) for the 1 watt amplifier. Black areas show where copper has been removed. All parts except transistor and heat sink are mounted on copper side. Be careful not to ground the transistor case or heat sink as it is internally connected to the collector.



PARTS LIST 1–6W AMP
Q1 – 3N3925
L1 – 3½T no. 18, 0.7 cm I.D., 1.5 cm long
C1 – 4–40 pF (ARCO 403)
C2 – 7–100 pF (ARCO 423)
RFC_1 – 2½T no. 18, 0.7 cm I.D., plus ferrite bead
RFC_2 – 3T inside **6** hole 200 MHz ferrite bead

Fig. 3. Full size PC board layout (copper side) for the 6 watt amplifier.

happened to be in my junk box). The other change is the transistor, Q2. It is a Motorola 2N3925 which I chose for several reasons: (1) It isn't too expensive ($5.35 in single quantities), (2) It is easy to mount and work with, and (3) It can put out 6 to 7 watts with 1.4–1.6 watts of drive. The board layout is somewhat different, because the device has a different package and requires a larger heat sink. For a heat sink, I mounted a piece of 0.7 (¼") aluminum under the board, using 0.7 cm (¼") spacers. The leads of the device all went through a 0.8 cm (7/16") hole in the board. The leads were then bent over and soldered to their appropriate areas. Make sure the transistor nut and the spacer screws are secure before you solder the transistor leads. Also, don't let the case of the device (near the leads) touch anything, as the case is connected to the collector. The stud on the other end is electrically isolated from the elements inside, so it is not necessary to insulate it from the aluminum heat sink. Be sure to use a good quality heat sink compound here.

Tune-up of both amplifiers is straightforward – you tune for maximum output. If you build both of them, tune the low power

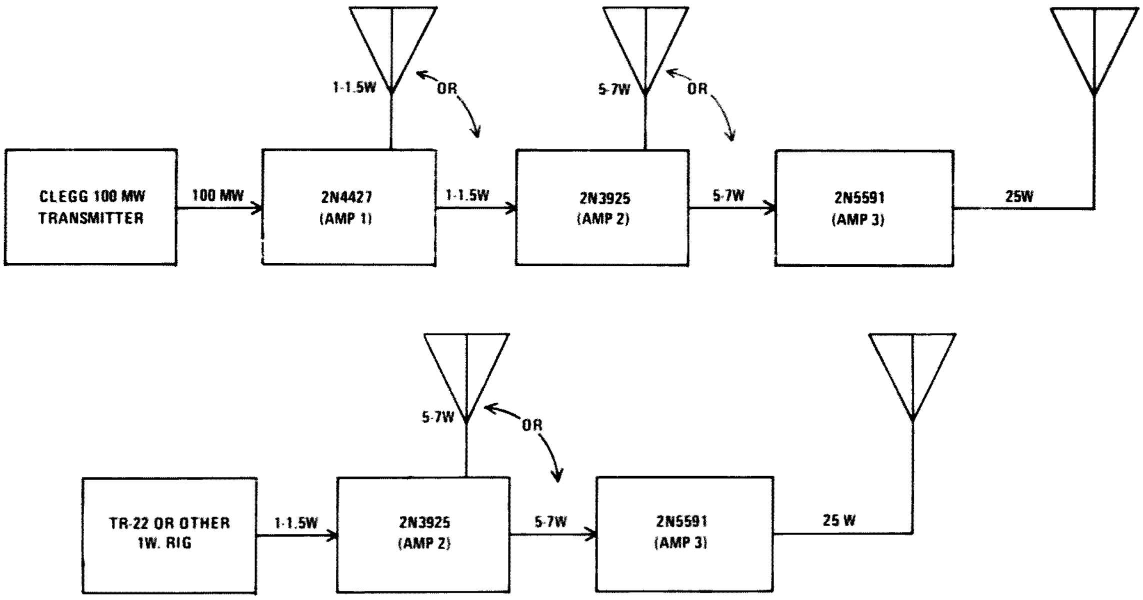


Fig. 4. Various methods of connecting the amplifiers for getting different power outputs. The amplifiers can all be built on the same board with shielding between sections or on separate boards connected via short pieces of coax.

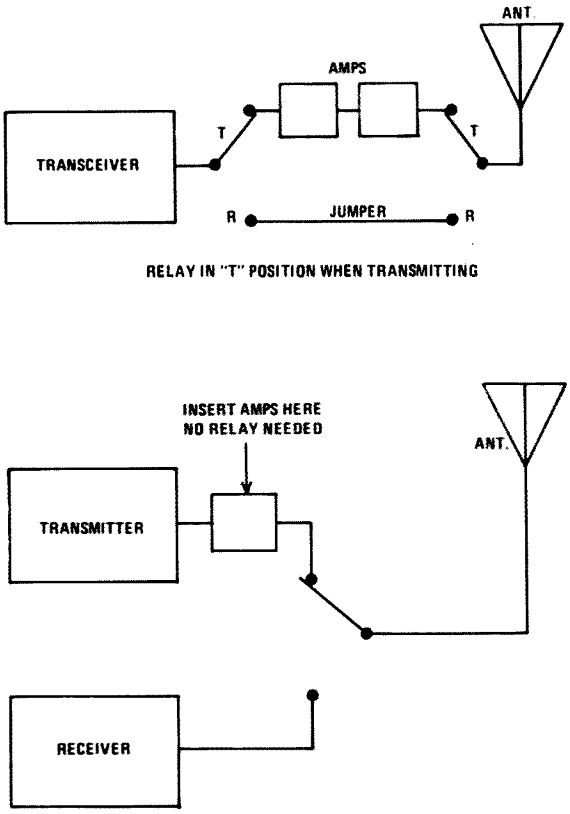


Fig. 5. Two ways to connect the amplifiers when using either a separate receiver and transmitter or a transceiver.

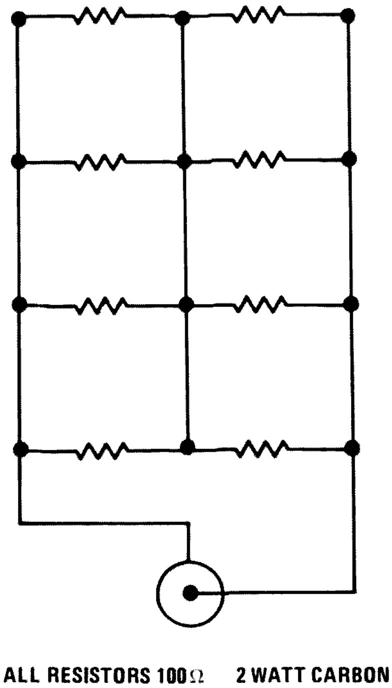
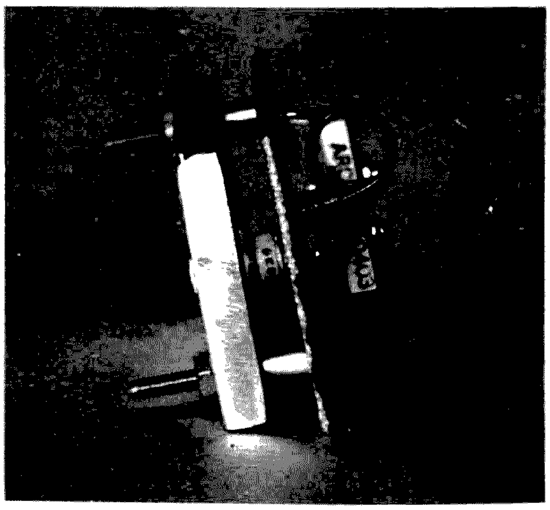


Fig. 6. A simple dummy load for tuning the amplifiers. Keep tuneups short when running 25 watts.

stage first. It should then be re-tweaked, after connecting it to the 7 watt amp. You may have to squeeze or stretch LI, but not by very much. When driven by the 2N4427, the 2N3925 should give around 6–7 dB of gain. Together, they should



Side view of the 6 watt amplifier showing heat sink details.

deliver at least 15–16 dB gain. When tuning, it is advisable to use a good rf indicator, such as a Bird Thruline or other VHF indicator. Also, be sure to use a 52 ohm non-inductive load.

If desired, these amplifiers can drive the 2N5591 amplifier (December 1972 *73*). You can then get 25 watts out when driving them with one of the small International Signal 2 meter boards. I recommend keeping the voltage on the ISC board around 10 to 11 volts, as the output transistor goes bad if anything over 12 volts is applied.

If you have a rig that puts out 1 to 1.5 watts, simply eliminate the 2N4427 stage, and you can get 25 watts output using the last two stages.

Also, be sure to put the amplifier(s) between the transmitter and the T-R relay. If you put it between the relay and the antenna, your receiver will not function as a received signal won't feed through them. If desired, you can use a DPDT relay to switch the amplifiers into the antenna line when transmitting, and out when receiving.

. . .WB4DBB

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"MINI" REPEATER CONTROL SYSTEM

PART ONE

After designing and building a rather elaborate fully digital 2 meter repeater control system (a full description of this system has been published in book form by 73 Inc., Peterborough NH), it has been challenging to design and build a "Mini" repeater control system. The new system provides the most frequently desired repeater services, employs a minimum of parts, and furnishes reliable, trouble-free service. The resulting system is fully described here. The repeater control system was physically constructed in a way which allows it to be quickly removed from the normal interface circuitry. A companion diagnostic test set (DTS) was built to provide a way of verifying proper operation of the system logic. It will be described in Part II.

The control system is used in conjunction with a 2 meter transmitter and receiver and the following "support" circuits:

1. Carrier detector
2. Burst Tone Decoder
3. Touch Tone Decoders for three frequencies; 941, 1209, and 1477 Hz
4. Telephone Ring Signal Detector
5. Transmitter Keying Circuit
6. Tone Generator for identification
7. Audio Changeover

This combination of basic elements enables the system to provide two fundamental services:

1. A basic repeater function operating in either open or closed mode; closed mode means that a burst tone is required.
2. An automatic phone patch mode allowing incoming as well as outgoing telephone calls.

The Repeater Mode

When operating in the repeater mode, access can be either open or closed. If closed operation is desired, either burst access, whistle-up, or continuous tone squelch can be employed. A 2-minute timer limits continuous transmissions to no more than two minutes; this provides a forced shutdown if a spurious signal persists on the input frequency.

The Autopatch Mode

The autopatch mode is entered when a user transmits the Touch-Tone "*" character. In this mode the transmitter is keyed continuously for the duration of the patch. The 2-minute timer is reset each time the input signal ceases – this prohibits a false shutdown. A 1-minute timer provides control of the telephone line; if the user fails to

transmit at least once each minute, the autopatch is released and the repeater mode is reentered. This timer provides system recovery in the event the user is unable to retain control (drives out of range, transmitter fails, etc.). The user terminates a telephone call by transmitting the Touch-Tone "#" character. The system then reverts to the repeater mode. The repeater mode is also entered if the 2-minute timer expires when the system is functioning as an autopatch. (This means that the user transmitted continuously for two minutes.)

In order to provide the user with control over the called party during those times when the radio party is transmitting, the control logic produces an "audio switch-over" signal which can be used to alter the audio input to the transmitter. This circuitry can be used to switch the transmitter's input to a tone generator ("marker" signal) or another source of audio such as the receiver's output. Such circuitry assures the system user that the telephone party will not "talk behind his back" and thereby broadcast profanity or other illegal transmissions. If such an undesirable transmission occurs while the user is listening, the called party can be silenced by the user keying his transmitter. If a "marker" signal is used, semi-privacy results since the user's voice is not heard on the output frequency.

The system logic thus maintains control over the transmitter and telephone line under all conceivable conditions.

Identification

The Federal Communications Commission requires that repeaters identify at five minute intervals during the period of usage. When use of the repeater ceases, it is desirable to have the repeater identify immediately. This presents a dilemma: each time the transmitter shuts down it *may* imply the end of a usage period; on the other hand, it may be the case that users of the system are not making quick exchanges. Three modes of operation come to mind:

1. Identify every three minutes
2. Identify every time the transmitter is about to shut down
3. "Anticipate" the end of a usage period and then identify

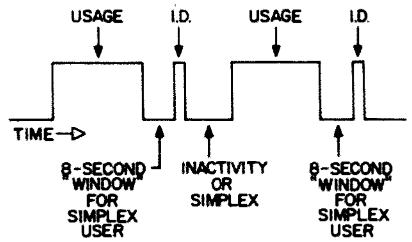


Fig. 1. Anticipator and identification scheme.

Each of these modes exhibits both desirable and undesirable characteristics. The third approach does not generate a large number of superfluous I.D.'s as does number 2 and does not generate an I.D. "out-of-the-blue" – as much as three minutes after the last period of usage – as does case 1. (Case 1 is particularly annoying if the repeater output is located on a popular simplex frequency. A simplex QSO may begin following a period of repeater usage and then be temporarily QRM'd during the final I.D. that the repeater generates.)

An anticipatory identification scheme is provided in the "Mini" repeater control system. The logic assumes that a lack of transmitter usage for 8 continuous seconds implies that the usage period has ended and that an I.D. is therefore appropriate. If the users tailend, or at least respond in less than 8 seconds, the repeater will identify only once every 3 minutes followed by a final I.D. at the end of the usage period.

By changing a single resistor, the anticipator's time period can be adjusted to suit your own particular taste. If the time period is equal to zero seconds, the repeater will identify as in case 2; if the time period is greater than three minutes, the repeater will identify as in case 1. The anticipator discourages the use of the repeater by only a single user, i.e., one person going through the repeater and the other person operating simplex on the output frequency. With an anticipator, the simplex user must transmit through the "time window" that exists between the end of the repeater's transmission and the start of the I.D. (See Fig. 1.)

Figure 2 shows how the anticipator and 3-minute timer work together during a period of repeater usage.

Tone Access

The "Mini" repeater control system provides the circuitry necessary for correctly operating the system as a burst access, whistle-up, or continuous tone repeater. The logic associated with the access method includes a circuit that "remembers" that a tone has been received. A timer is used to govern how long the system remembers that a tone has been received. If the timer is set to 5 seconds, tailending is allowed for 5 seconds and the effective loss of signal due to flutter or chop is filtered out of the logic. A long time period, for example 5 minutes, would implement a "whistle-up" repeater that would remain available, and open, for at least five minutes; continued use would cause the system to remain active indefinitely. Simple internal wiring changes will implement a continuous tone access system.

System Logic

The "Mini" repeater control system was implemented using TTL logic devices because these devices are currently available at attractive prices. Whereas a more state-of-the-art approach to identification could have been used, e.g., use of ROM for identifier memory, TTL gates were used throughout because of their availability.

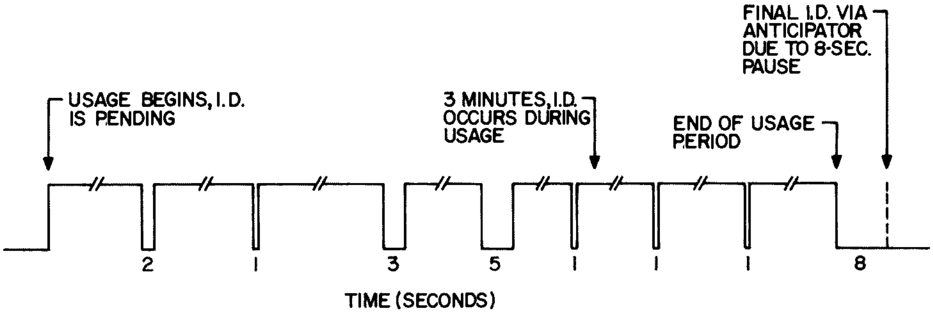


Fig. 2. Anticipator and 3-minute timer working together.

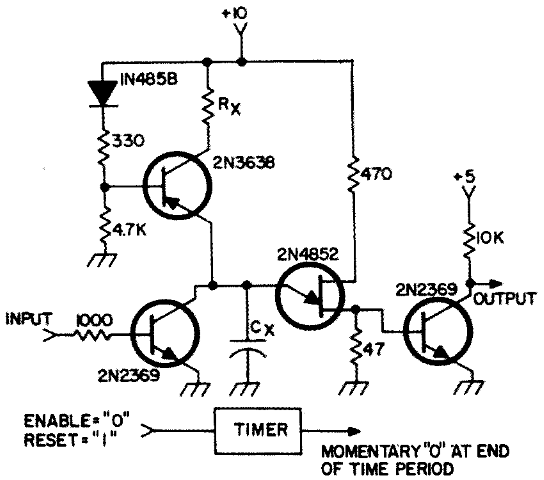


Fig. 3. Timer circuit.

The logic can be functionally broken into several sections:

1. *Timers* – A 5-second, 8-second, 1-minute, 2-minute, 3-minute timer and the clock pulse generator for the identifier.
2. *System Control* – The repeater and autopatch functions.
3. *Identifier* – Character generator, character counter, and tone generator control.
4. *Decoding* – Generating a specific sequence of dots, dashes, and blanks.
5. *External Interfaces* – Formal inputs and outputs.

Timers/Clock

The timers and clock pulse generator were implemented using the "standard" circuit shown in Fig. 3. (The recent appearance of the Signetics NE555 low-cost I.C. timer offers an economical source of accurate time signals. Such a device would represent a very significant improvement over the circuit used in this system. See *Electronics*, May 8, 1972, page 127.) In order to change the circuit s characteristics, Rx and Cx were appropriately chosen. The clock pulse generator used a value of 693K ohms for Rx and .1 microfarads for Cx to produce a comfortable I.D. speed. A "standard" 68 μF capacitor was chosen for Cx for all of the timers. Experimental data was then plotted to generate the graphs shown in Figs. 4 and 5.

Figure 4 is used to select Rx for the anticipator and burst access timers, while Fig. 5 is used to select Rx for the 1, 2, and 3 minute timers. Using these graphs you can adjust the timers to the time periods you prefer for your particular repeater installation.

The basic unijunction timer circuit includes a constant current source for charging Cx to minimize the effects of voltage variations. Quality components should be used to minimize the effects of temperature changes. To evaluate the effects of temperature change, a "standard' circuit was constructed with a time period of 73 seconds. The circuit was then placed in the family deep freeze and finally in the oven. When operated in the deep freeze (<10° F.) the time period was 84 seconds; the oven (145° F) yielded a time period of 77 seconds. Resistor Rx was a precision resistor and Cx was a 68 μF tantulum capacitor. (Most of the noted time

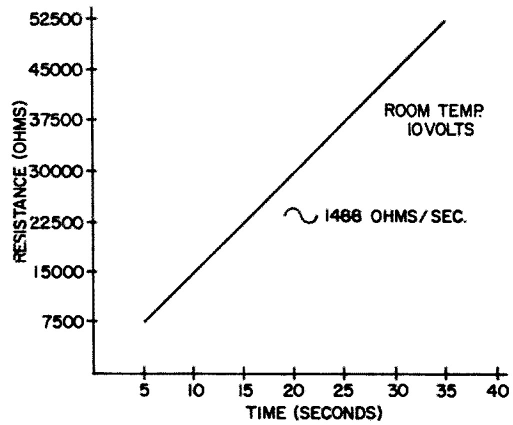


Fig. 4. Graph used to determine Rx for the anticipator and burst access timers.

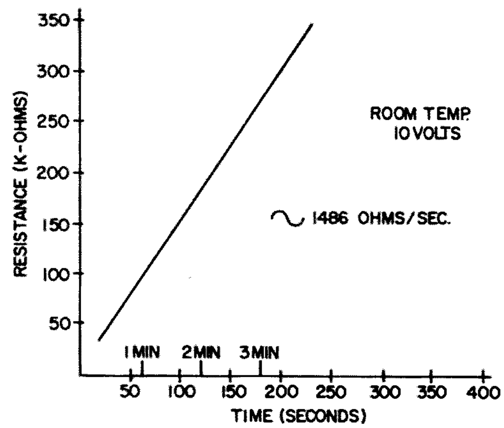


Fig. 5. Graph used to determine Rx for the 1, 2 and 3 minute timers.

period change can probably be traced to a change in the unijunction's intrinsic standoff ratio).

From a logical point of view, the timer circuit has a single input and a single output. Time is accumulated when a logic 0 is applied to the input. A momentary logic 0 is produced at the output when the timer expires; e.g., if a continuous logic 0 is applied to the input of the 1-minute timer, a momentary logic 0 will be produced at the output one minute later.

System Control

The system control logic was implemented using 9 integrated circuits. These nine IC's contain two 4-input gates, six 3-input gates, and twenty-four 2-input gates; 31 gates are used. Twelve of these gates are connected in a cross-coupled manner to implement simple set/reset fllp-flops for the following memory functions:

1. Has an access tone been received?
2. Has a valid signal been received?
3. Is the system operating in the repeater mode or the autopatch mode?
4. Has a 2-minute timeout occurred?
5. Is an I.D. pending?
6. Is an I.D. in progress?
7. Has a "*" been received?

Figure 6 shows the system control logic. Since the timers are all easily adjusted to suit an individual system's needs by selecting the value for Rx, Fig. 6 shows the timers in a general 2-terminal manner. Although various operational characteristics can be implemented by selecting time values different from those discussed in the text, for ease of discussion, the symbolic timers are interpreted as follows:

Timer A 5-seconds
Timer B 1-minute
Timer C 2-minutes
Timer D 3-minutes
Timer E 8-seconds

NOTE: *In the discussion that follows an I.C. pin will be referred to by an I.C. identifier followed by a dash and a pin number, i.e., E2-7; a flip-flop will be referenced by the identifiers of the two gates used to implement the flip-flop, e.g., A2/A3.*

The memory flip-flops are composed of the following gates:

AA2 and AA3
This flip-flop is set when an access tone is received. It is reset 5 seconds after the carrier is removed from the input frequency. When the system is operating in the patch mode, the flip-flop is constantly set to nullify the need for a burst tone. Pins AA2-6 and AA2 7 are the set terminals and AA3-13 is the reset terminal.

A2 and A3
This flip-flop is set when a valid signal has been received; pin A2-5 is the set terminal and pin A3-8 is the reset terminal.

B4 and C1
This flip-flop specifies in which mode the system is operating; pin B4-12 is the set terminal and pins C1-1, C1-2, and C1-3 are the reset terminals. If the flip-flop is reset, the system is functioning as a repeater.

E2 and E3
This flip-flop is set when a 2-minute timeout occurs; pin E3-9 is the set terminal and pin E2-5 is the reset terminal.

G1 and F4
This flip-flop is set when a request for the transmitter is granted; the flip-flop thus indicates that an I.D. is pending, i.e., eventually required; pin G1-1 is the set terminal and pin F4-13 is the reset terminal.

D3 and G4
This flip-flop is set when an I.D. is in progress; pins D3-11 and D3-12 are the set terminals and pin GR-13 is the reset terminal.

BB2 and BB3
This flip-flop is used to prohibit the "*" character from entering the telephone line when the patch is being accessed. The flip-flop is set at the end of the first "*" character; additional "*" characters are then allowed to pass to the telephone line. Pin BB2-5 is the set terminal and pin BB3-9 is the reset terminal.

NOTE: *Flip-flops implemented using cross-coupled gates are set by applying a logic 0 to the set pin; they are reset by applying a logic 0 to the reset pin.*

The remaining gates are used as conventional NAND gates (if *any* input is a logic 0, the output will be a logic 1; if all inputs are logic 1's the output will be a logic 0–. With TTL logic, "ground" is a logic 0 while the

power supply (through a suitable series resistor) is a logic 1.

Each of the logic gates performs an essential function in the total control system. The following paragraphs describe the detailed operation of the logic.

Gate A1 applies a logic 0 to the set terminal of flip-flop A2/A3 whenever a carrier is simultaneously accompanied by a logic 1 output from the access tone flip-flop AA2/AA3 decoder. If an access tone is not required, pin A1-2 can be connected to pin A1-1. When the carrier leaves the input frequency, the carrier signal becomes a logic 0 thus resetting flip-flop A2/A3 via pin A3-8. In this manner, flip-flop A2/A3 tells (via pin A2-7) whether an acceptable carrier is being received. In this implementation, the simultaneous presence of carrier and burst tone sets the flip-flop while loss of carrier resets the flip-flop. If a continuous tone squelch system is desired, pin A3-8 should be moved from A1-1 to A1-2. This change causes flip-flop A2/A3 to be reset when the tone is lost rather than when the carrier leaves (they would in fact normally leave at the same time). Connected in this manner gates A1, A2, and A3 perform a simple ANDing operation. The "access tone" signal applied to A1-2 is derived from the circuitry composed of timer A and gates AA1, AA2, and AA3. By appropriately selecting the time period of timer A, several modes of operation are possible. With gate A1 connected as shown in Fig. 6, the logic implements either a burst access or whistle-on repeater.

If the patch mode is not in progress, AA2-7 will be a logic 1; therefore, when ACCESS is a logic 1, indicating the presence of a tone, gate AA1 will apply a logic 0 to AA2-6 thereby setting flip-flop AA2/AA3. With AA2/AA3 set, gate A1 recognizes the presence of the burst tone until such time as AA2/AA3 is reset. Timer A functions as a "low pass filter" in that short duration interruptions of carrier will not cause AA2/AA3 to be reset. If timer A has a period of 5 seconds, AA2/AA3 will not be reset until 5 seconds after the input signal is removed. This allows for "tailending" by users not equipped with tone burst generators. If timer A were reduced to zero seconds (i.e., replaced by a single conductor) tailending would not be possible; also, a momentary loss of signal, due to chop or flutter, would reset AA2/AAE and thereby disable the transmitter. It is therefore evident that a non-zero value for timer A is appropriate.

If timer A were set to have a five minute time period, a carrier could leave the input for five minutes before flip-flop AA2/AA3 would be reset. When operated in this manner, the logic implements a "whistle-on" repeater; a user can whistle to generate a tone that in turn sets flip-flop AA2/AA3.

To implement a continuous tone access system (a tone must be present all the time) A3-8 is connected to A1-2 and the input to timer A is connected to AA1-1, AA1-2, and AA1-3. In this case, timer A determines how long a loss of tone will be tolerated; again a non-zero time is desirable to offset the detrimental effects of chop and flutter.

Flip-flop AA2/AA3 is permanently set when the patch mode is entered; this feature is provided by input AA2-7 being connected to the systems mode control flip-flop B4/C1. If this connection is omitted (AA2-7 then connected to AA2-6) burst tone will be required during patches. The present of the tone may be annoying to the party on the telephone; on the other hand, the tone may be regarded as a way of informing the called party that he is talking on a radio circuit and that the radio party is going to speak. (NOTE: If continuous tone operation is employed, AA2-7 should be connected to AA2-6. Since continuous tone systems use nearly inaudible frequencies the tone would not be objectionable; furthermore, if AA2-7 is connected as shown in Fig. 6, flip-flop A2/A3 would *never* be reset since the output of gate AA1 would never go to logic 0!)

If the mode of operation (open or closed) is to be controlled on a selective basis by either a locally operated manual control switch or by a remote control facility (via UHF or landline), the ACCESS input to gate AA1 should be interfaced to the "outside world" through a suitable interface circuit (See Fig. 10) When tone access is desired, the output of the tone detector should be applied to AA1; when the repeater is "open," a logic 1 should be applied to AA1.

If pin A2-7 is a logic 1, then if the RPTR

ENABLE input is a logic 1, gate B1 will produce a logic 0 output. Gate C2 "gathers" transmitter requests; a request consists of a logic 0 supplied to any of C2's inputs. These inputs are termed "transmitter requests" since the transmitter is keyed only when the 2-minute timer has not expired.

Gate E4 processes the transmitter requests by simultaneously examining the outputs of gates C2 and E2. Pin E2-7 is a logic 1 unless a 2-minute timeout has occurred. If the two inputs to E3 are logic 1's, then the output of E4 is a logic 0. Gate D2 gathers valid transmitter requests; any logic 0 input will cause the transmitter to be keyed via the external inferface circuit connected to pin D2-9. When gate E4 passes a transmitter keying request and applies a logic 0 to pin D2-8, it simultaneously sets flip-flop G1/F4 via the application of the logic 0 to pin G1-1; when flip-flop G1/F4 is set it indicates that an I.D. is pending. Note that the other inputs to D2 (pins D2-6 and D2-7) do *not* set flip-flop G1-F4. One of these inputs is from a local test switch while the other is from the identifier control flip-flop D3/G4. (Note that if the identifier's request for the transmitter *did* set flip-flop G1/F1 then the system would identify every 3 minutes whether the system was in use or not! The logic allows the identifier access to the transmitter even if a timeout has occurred. Thus, after a timeout, an identification will occur.

Gate E1 controls the 2-minute timer; if either input is a logic 0, the timer will be reset by E1's logic 1 output. Pin E1-2 is a logic 1 when the system is operating in the repeater mode since pin B3-9 will be constantly held at logic 0 when in repeater mode thereby holding the output of gate B3 at the logic 1 level. Consequently, when gate C2 receives a transmitter request, pin E1-1 also becomes a logic 1. With both inputs a logic 1, the output of gate E1 is a logic 0 and the 2-minute timer runs. If the 2-minute timer expires, its logic 0 output is applied to pin E3-9 thereby setting flip-flop E2/E3; with this flip-flop set, gate E4 blocks the transmitter requests normally passed to gate D2. When the system operates in the autopatch mode, the transmitter is keyed continuously for the duration of the patch but the 2-minute timer is reset each time the input carrier leaves.

Gate B3 samples the mode flip-flop B4/C1 and the signal flip-flop A2/A3. If a signal is not present (pin A3-11 is a logic 1) and the autopatch mode is in effect (pin B4-14 is a logic 1) then both inputs to gate B3 are logic 1's and the output is thus a logic 0. This resulting logic 0 is applied to gate E1 pin E1-2 which in turn generates a timer C reset signal (logic 1). Observe that at this point the transmitter is keyed and the 2-minute timer is *not* running. Although this initially seems to be incorrect, if the user fails to transmit within one minute, the 1-minute timer will cause the system to revert to being a repeater. When this occurs, the lack of input signal will result in no transmitter request and the transmitter will no longer be keyed.

The autopatch mode is entered when all of the inputs to gate D1 are logic 1's. This occurs when the AUTOPATCH ENABLE signal is a logic 1 and the two tones representing "*" are detected. Under these conditions, the output of gate D1 becomes a logic 0 thereby setting flip-flop B4/C1. The autopatch mode is terminated when the proper two tones representing "#" are received which in turn apply logic 1 inputs to gate A4. The resulting logic 0 output from gate A4 resets flip-flop B4/C1; the system thus reenters the repeater mode. Pins C1-2 and C1-3 provide two additional ways to exit the autopatch mode: pin C1-2 is connected to the 1-minute timer while pin C1-3 is connected to the 2-minute timer. Thus the autopatch mode will be explicitly terminated when the "#" is received and implicitly terminated whenever a one or two minute timeout occurs. Figure 6 shows TONE1 and TONE4 strapped together since the "*" and "#" have one tone in common, namely, 941 Hz.

The "*" character is a convenient autopatch access character; however, transmitting the "*" character into the telephone line will generally cause a "reorder" tone to be generated when the central office is expecting a series of digits. (Any of the 16 Touch-Tone characters may be sent after the

called party has answered.) The "Mini" repeater control system employs special circuitry to inhibit the connection of the patch until the access character has ceased. Gate BB1 and flip-flop BB2/BB3 assure that the patch will not be attached to the telephone line until *after* the "*" character has been received.

If a "*" is being received, pin D1-5 will be a logic 0 and pin B4-14 will be a logic 1. When the tone ceases, flip-flop B4/C1 is set and pin D1-5 is a logic 1. Consequently, both inputs to gate BB1 are logic 1's. The output of BB1 is therefore a logic 0 which sets flip-flop BB2/BB3. This flip-flop is interfaced to a transistor switch which operates the relay associated with connecting the patch to the telephone line. The flip-flop is reset when the patch mode is terminated – pin BB3-9 becomes a logic 0 and causes the flip-flop to reset. Note that while the first "*" character is "blocked" from the telephone line, additional "*" characters will be passed. This allows the user to place calls to automatically answered computer systems that might in turn require the caller to send special characters such as the "*" and "#."

The 1-minute timer is controlled by gates F1 and F2. Gate F1 causes the timer to be reset whenever a valid signal is present and the system is in the repeater mode; when both of the inputs are logic 1's, the resulting logic 0 output is applied to gate F2 thereby causing pin F2-7 to assume a logic 1 which functions as the 1-minute timer reset signal. Gate F2 will also produce a logic 1 output if pin F2-5 is a logic 0; this is precisely the case when the system is in the repeater mode (pin B4-14 is a logic 0). This inhibits the 1-minute timer when it is not in use. Gate F3 is provided to invert the output of gate F1; gate F3 produces a logic 1 output when the system is in the autopatch mode and a carrier is present. The output of gate F3 is used to control external circuitry for selecting an alternate transmitter audio input signal during those times when the user is transmitting.

Gates G2 and G3 work in conjunction with the 8-second timer, timer E, to implement the anticipatory identification logic. The 8-second timer is enabled whenever the transmitter is not keyed (gate D2's output is a logic 0). When the timer expires it produces a logic 0 which is inverted by gate G2 thereby applying a momentary logic 1 to pin G3-8. If an I.D. is pending, flip-flop G1/F4 is set (pin G1-3 is a logic 1) and so both inputs to gate G3 are at the logic 1 level; the result is a logic 0 output from gate G3. When the logic 0 output is applied to pin D3-11, flip-flop D3/G4 is set. With flip-flop D3/G4 set, pin G4-14 is a logic 0 and the I.D. clock pulse generator is enabled (see Fig. 7). When the I.D. is complete, a logic 0 is applied to pins F4-13 and G4-13 by the output of gate Z (see Fig. 9) thus resetting the I.D. circuitry.

Flip-flop D3/G4 can be set by the 3-minute timer's output and also by a local I.D. request switch; both of these signal sources apply a momentary logic 0 to pin D3-12.

Enable Signals

It is significant to observe and understand the effect of the two enable signals on the system's operation. The AUTOPATCH ENABLE input only controls *entry* into the patch mode; removal of the AUTOPATCH ENABLE signal during a patch does not cause the patch mode to be terminated. The REPEATER ENABLE input causes the transmitter to be disabled for autopatch and repeater modes; telephone ring signals will continue to be broadcast (incoming calls can be ignored by disconnecting the ring detector from the telephone line).

Identifier Character Generator

The identifier character generator logic was implemented using 6 integrated circuits. Four of the integrated circuits are dual J/K flip-flops (with separate clocks). One integrated circuit consists of four 2-input gates; two "half" I.C.'s are used – one 4-input gate and two 2-input gates.

Flip-flops H1 and H2 are used in conjunction with gates I1, I2, I3, and I4 to implement a character generator. Clock signals are generated by a unijunction oscillator circuit (see Fig. 3). The output of gate I4, pin I4-14, is the inverted form of the desired message. Gate Y2 inverts the signal and is in turn interfaced with an external tone generator via the open collector transistor; the transistor turns on when a tone is required.

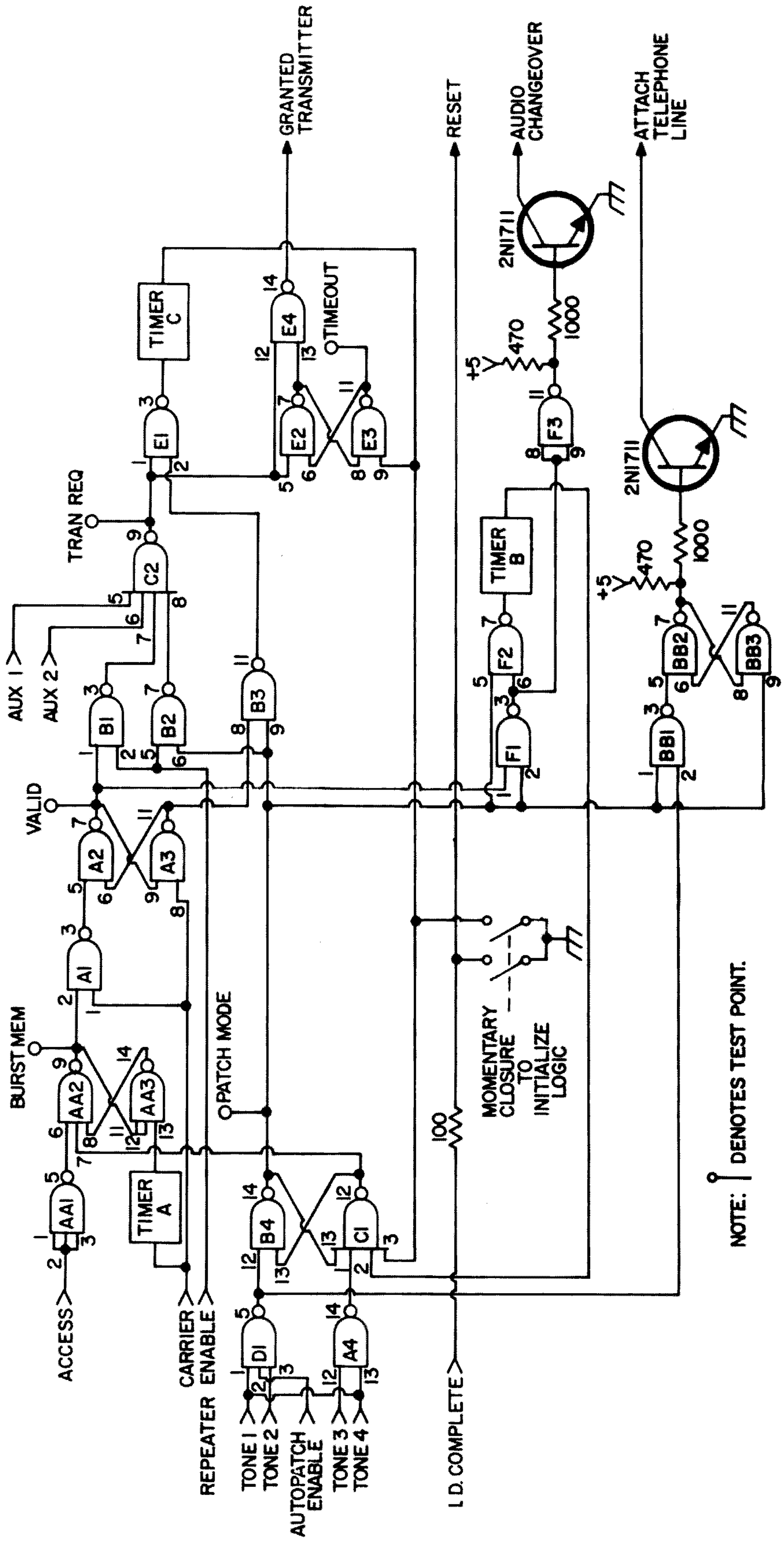


Fig. 6A. System control logic. Also see Fig. 6B.

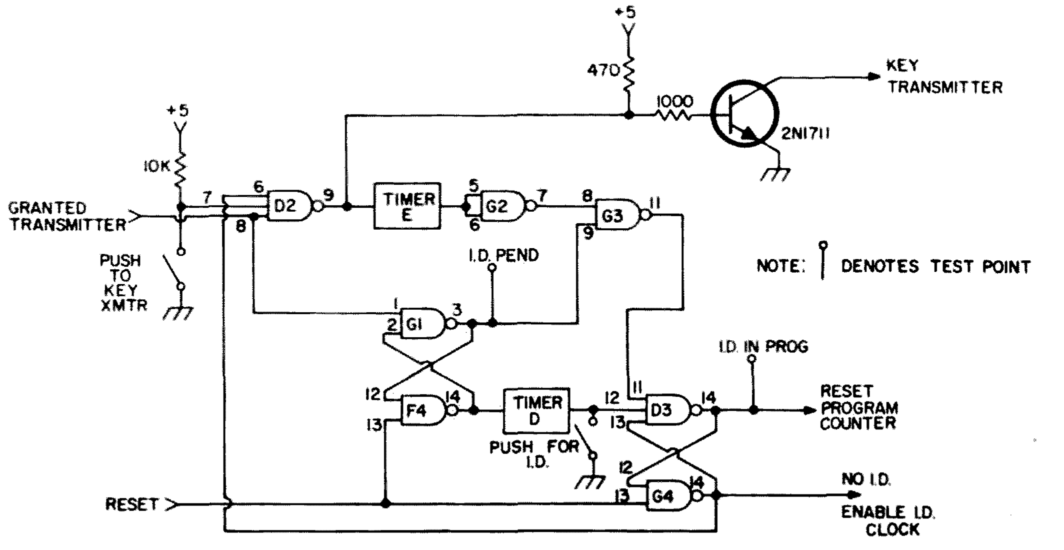


Fig. 6B. Continuation of system control logic.

The signal applied to pin Y2-5 is normally a logic 1 and therefore does not effect the generated Morse code message. Flip-flops J1, J2, K1, K2, L1, and L2 compose a 6-bit character counter. The 6-bit ripple counter is advanced at the completion of each dot, blank, or dash when the output of gate I3 (pin I3-11) goes from a logic 1 to a logic 0. (A discussion of this circuit was included in the article, "Integrated Circuit CW ID Generator," P.J. Ferrell, *73 Magazine*, September 1970.) With a 6-bit counter, large messages can be easily generated. When a logic 1 is applied to gate I1, a "blank" is generated; when a logic 1 is applied to gate I2, a "dot" is generated; when the inputs to gates I1 and I2 are both logic 0, a "dash" is generated.

Figures 8 and 9 show the decoding logic that was applied to only the first five flip-flops (J1 through L1). The decoding

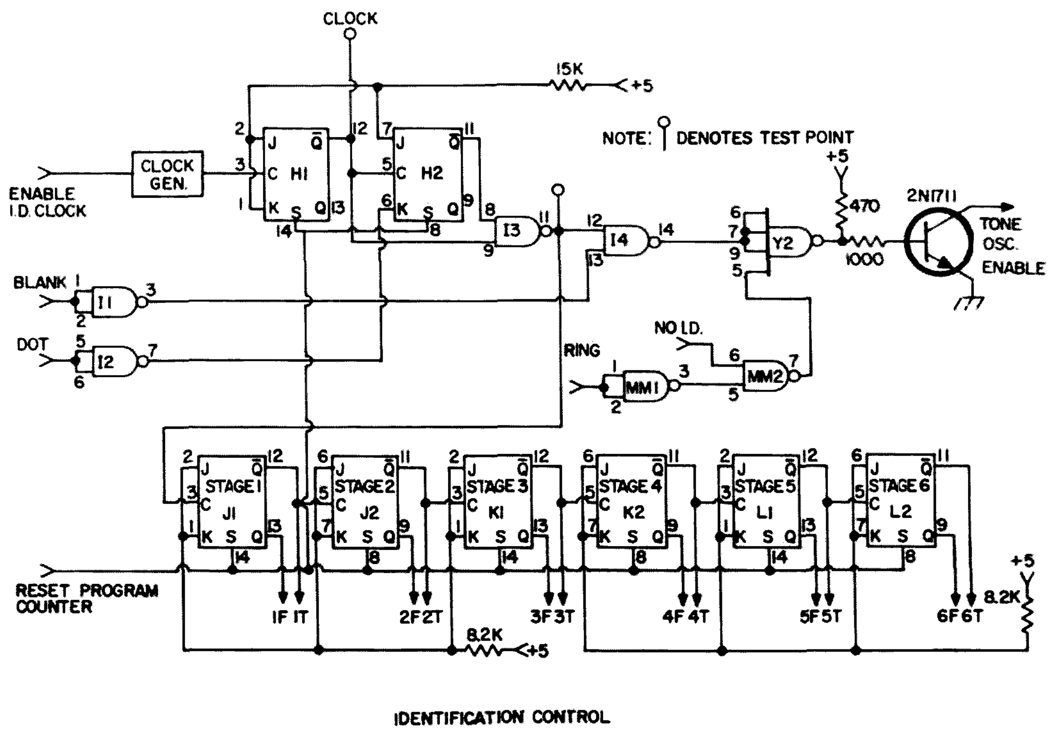


Fig. 7. Identification control.

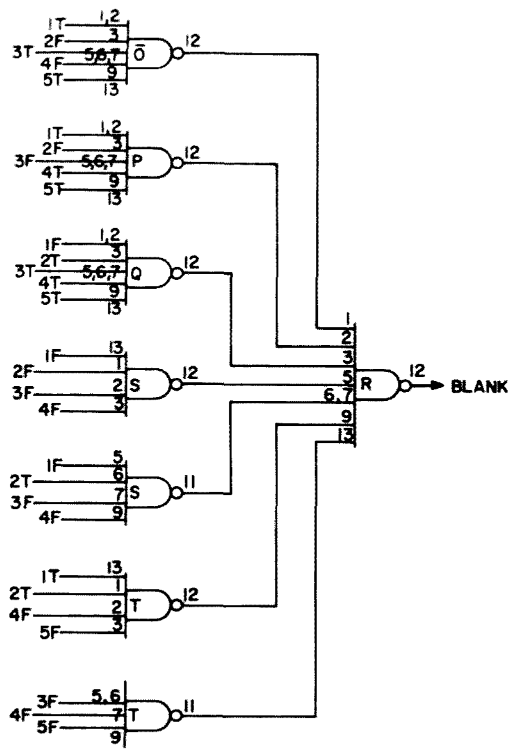


Fig. 8. Blank decoding logic.

logic shown produces the message:

S
b̸b̸b̸b̸b̸WAØVWJ T
O
P

When the counter reaches the value 31, the output of gate Z goes to a logic 0; this is the signal applied to gates F4 and G4 (Fig. 6) to signal the end of the I.D. sequence.

Call Letter Decoding

Various techniques exist for decoding the character counter and producing the "BLANK" and "DOT" signals; available methods include programmable read-only memories, diode matrices, and NAND gates. Figures 8 and 9 show the gate interconnects used for the WAØVWJ message. (One method for determining the proper minimal interconnects is given in reference 1).

The system control logic shown in Fig. 6 was designed to interface with either the logic shown in Figs. 7, 8, and 9 or with an I.D. mechanism of the user's choice. For example, if a tape recorded message is to be used, the output of gate D3 (pin D3-14) can be used to turn on a transistor switch that starts the tape playback unit; the tape player

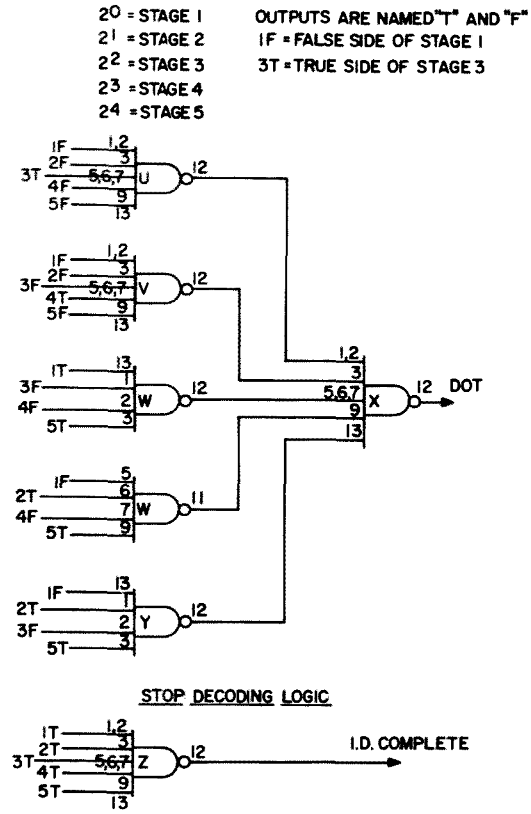


Fig. 9. Dot decoding logic.

need only supply a "stop" signal (logic 0) for gates F4 and G4 when the message has been completed. In a similar manner, the logic can be interfaced with a "code wheel" providing that a "stop" signal is returned when the message has been completed.

Auxiliary Logic - Incoming Telephone Calls

Gate C2 contains two auxiliary inputs for transmitter requests. While the basic logic provides for repeater and autopatch operation, one of these two inputs can be used to implement a "call in" feature. When a telephone ring signal is received, an external circuit applies a logic 0 to pin C2-6; this produces a request for the transmitter. If the 2-minute timer has not expired, the transmitter is keyed. Simultaneously, gates M1 and M2 determine whether or not an I.D. is in progress. If an I.D. is not in progress; the output of gate M2 produces a logic 0 input to gate Y2 thus enabling the tone generator. Thus, whenever the telephone rings, a tone is broadcast for the duration of the ring signal providing that an I.D. is not in progress. If the time period of the anticipator (timer E)

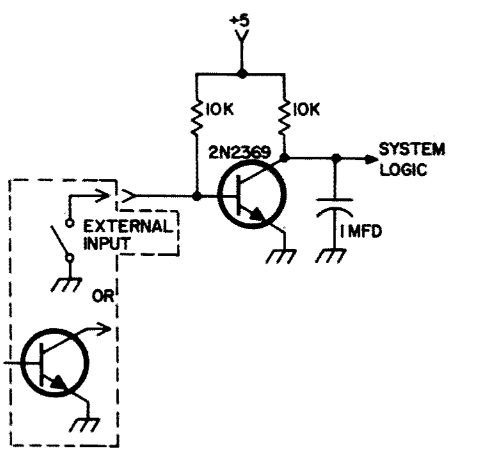


Fig. 10. "Support Circuits" apply a contact closure to ground when a logic 1 is to be generated (e.g., carrier present). This circuit produces a TTL logic 1 (>3.5 volts) which is applied to a specific TTL gate input pin.

is set longer than the time between telephone ring signals, an I.D. will follow the last ring signal broadcast. (If the ringing persists for more than 3 minutes, e.g., 5 minutes, an I.D. will occur at 3 minutes and then a terminal I.D. will occur at 5 minutes.) If the anticipator timer is too short, I.D.'s will be initiated after *each* ring signal!

External Interfaces

Two types of external interfaces were provided for the "Mini" repeater control system:

1. Input/Output signals to the system "support" circuits.
2. Input/Output signals and logic status points to a companion diagnostic and test unit.

The system inputs are buffered (to eliminate noise spikes) via discrete component circuits such as the one shown in Fig. 10. The TONE2 input circuit does not use the 1 μF capacitor, use of the capacitor will seriously degredate the signal causing flip-flop BB2/BB3 to function improperly.

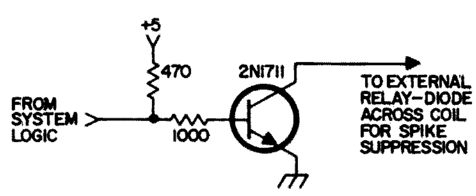


Fig. 11. Circuit of typical system output stage.

Ideally the "support" circuits should be included as an integral part of the control unit thus eliminating the interface circuit.

Packaging Technique

The control logic and the diagnostic test set were individually constructed on a chassis cover plate. Each cover plate contains the logic, power supply (+12 to +5), and interface cable receptacles. Each chassis can support two distinct units – one on the "top" plate and another on the "bottom" plate. (The chassis was installed on its side; the top and bottom therefore become side panels.) Photo 1 shows the construction concept used. This unique packaging technique, devised by WAØVWJ's owner, Chuck Fenwick, performs very well, providing modularity, easy removal for testing and modification, and excellent shielding. The chassis containing the system logic is normally connected to the system's support circuits (receiver carrier detector, transmitter keying circuit, tone generator, telephone ring detector, etc.) via two cables fitted with 10 pin plugs.

When desired, or when necessary, the cable from the diagnostic test set is attached to the system logic subassembly. This configuration allows the diagnostic test set to monitor the system's operation via the lamp display. By connecting only the diagnostic test set, the control logic can be fully

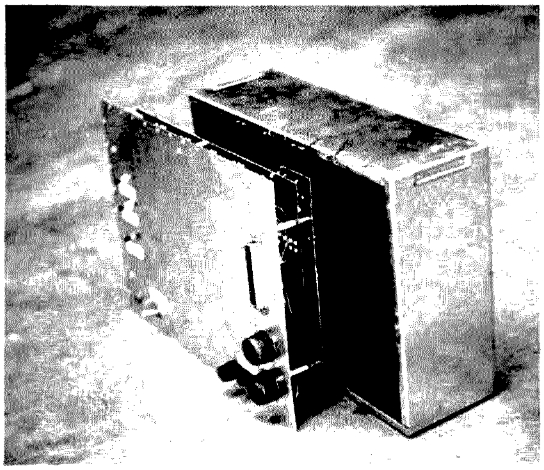


Photo 1. Main panel contains interface plugs, on/off switch, fuse, pilot light, local switches (i.e., key xmit, and logic initialization. Panel can be completely removed for easy servicing; when installed, shielding and dust proofing are automatic.

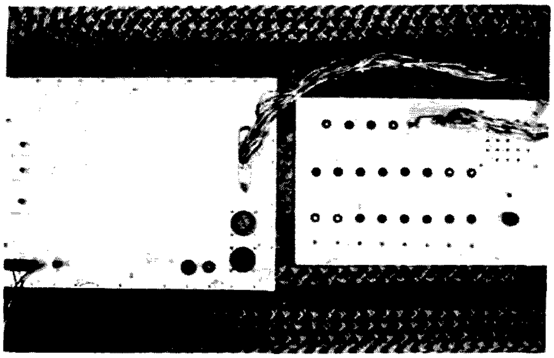


Photo 2. Operation in diagnostic mode. System interfaces have been disconnected.

exercised by manipulating the 8 input signal simulation switches. (See photo 2).

1. "Tailending" is generally incorporated in a repeater for at least one of the following reasons:
   1. To allow stations not equipped with burst tone generators access to the system when a burst equipped user is on frequency
   2. To minimize wear and tear on the transmitter keying circuitry

Timer A controls the amount of "open" repeater access time that will be allowed; the timer does not control the keying of the transmitter and therefore implements only the first of the above two reasons for tailending. (See No. 2 below)

The output of gate D2 is a logic 1 when the transmitter is to be keyed. This logic signal "follows" the input signal to the transmitter. If there is chop on the input signal, there will be discontinuities at the output of gate D2. In order to minimize wear and tear on the transmitter keying circuitry, the relay operated by D2's output should exhibit delayed dropout – 2 or 3 seconds should be adequate. Delayed dropout can generally be implemented by connecting a capacitor in parallel with the relay's coil. A moderate amount of capacitance will work well providing the coil resistance is at least several hundred ohms.

. . .WAØZHT/1

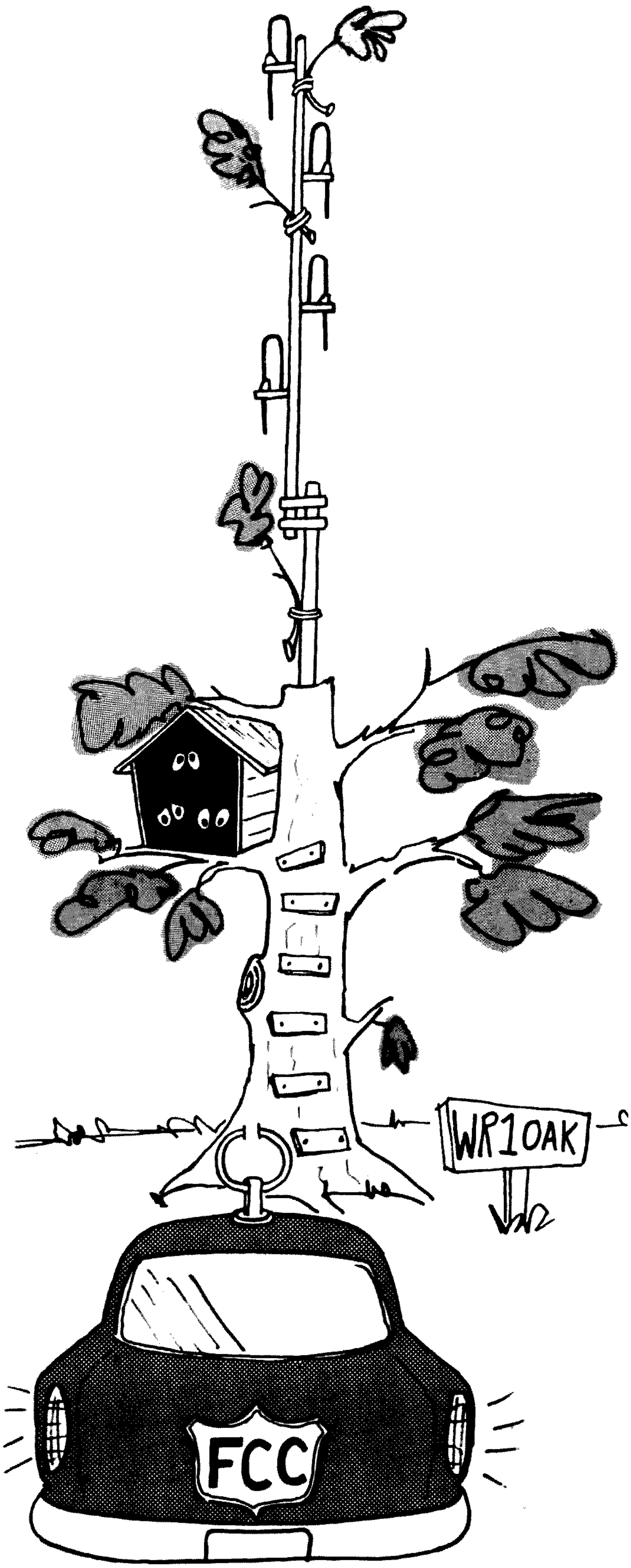
References:

1. "Designing Diode Matrix Units," T. R. Yocom, *73 Magazine*, January 1972, page 45.

GETTING YOUR REPEATER LICENSED

the easy way . . .

Wayne Green W2NSD/1
Editor-Publisher



A single article – even a monthly column – is not enough to keep up with the developments in this grey area – you almost need a daily report. You see, the FCC (and when you see the term "FCC" these days, this generally is a euphemism for Prose Walker) is sailing full speed ahead into uncharted waters.

Many FMers are at a loss to understand how the FCC could possibly have come up with such an incredible set of regulations for repeaters. The fact is unless someone (Walker) changes, repeater operation has had its back broken and the fastest growing – the single largest ham activity – the most valuable emergency communications system we have ever devised – will be so hobbled that further growth is questionable. This is why the normally silent ARRL has, for the first time in its history, publicly chastised the FCC.

The reason that FMers are unable to understand how the new rules came about is their involvement with FM. There is a simple explanation for what happened – and once you think about it in this frame of reference, everything fits into place and makes sense. If you forget all about FM, repeaters, repeater councils who are coordinating frequencies, simplex channels, scanners, squelch, – just forget everything you know about FM entirely. Now, put yourself in the position of writing rules for repeaters for 75 meters and you will see that everything falls into place.

If you start with that basic premise, you end up with regulations which take into

account the problem of simplex operation on the repeater input channel . . . and all of the other hassles that the FCC has built into the new rules.

The fundamental arguments FMers have against the new regulations are these: the requirement that a control operator be present at all times when the repeater is in operation will force many repeaters to go off the air during parts of the day or night . . . the restrictions on remote control are much too severe . . . the required timers to limit length of transmissions are not in the amateur spirit and are detrimental . . . the power limitations are unrealistic and should be removed . . . the frequency limitations are impractical and should be lifted . . . the antenna showings for license application should be deleted . . . the whole application system for repeater licenses should be simplified . . . crossband operation should be permitted . . . etc. It would take a large book to go into each of the deficiencies of the new regulations and present an adequate argument to back up the above. Much of this has been done in the past issues of *73* in the FCC columns, if you are interested in getting some perspective.

Getting Your License

Okay, down to the nitty gritty of filling out your repeater license application. This should be done on the latest FCC form 610 dated July 1972. You can get these from your friendly area FCC office or from the FCC, 1919 M Street NW, Washington DC 20554.

The first special showing you have to make for the repeater license is one of the height of your antenna above average terrain. To do this you will have to send for copies of the correct maps. First you get an index and ordering information from U.S. Geological Survey, Washington DC 20242 or Federal Center, Denver CO 80225. You want to buy the topographical maps with a scale of 1:250,000 and a contour interval of 50 feet. No, the maps you now have are not the right ones – you have, in all probability, the 1:62,500 scale 20 foot contour maps and, unless the right maps are unavailable you must follow instructions. Word is that the correct scale maps may not be available for California and a substitute will have to be made in this case. The maps cost $1.50 each and the chances are good that your repeater will be in one corner so you may have to buy four maps.

Once you have the right map or maps – get a compass and draw circles around the repeater site at every two miles out to the ten mile circle. Then draw a vertical and horizontal line through the repeater site – and two at 45° and 135°. Now you're ready to get out the magnifying glass and read off the contours at the junction of all those lines and circles. If you didn't goof, you should have forty numbers. Average them. That means add them all up and divide by 40. This is a splendid time to have that Heath calculator. The number you end up with is your height of average terrain – unless you live in Death Valley, in which case it would be the depth of average terrain.

Now take that map and cut out an 8½ x 11 in. section of it which includes all of those terrain circles. This is your exhibit number one for the application. Show the forty numbers and the average – as well as the height of the repeater site and the antenna at that site. Put these numbers on a separate sheet of paper – also 8½ x 11 in. Make all of your exhibits on that same size sheet.

Next they want to know the effective radiated power in the horizontal plane. This means that you have to submit an antenna pattern on polar graph paper. If you don't have said polar graph paper you can buy it – or, if desperate, send a sase to 73 for a couple of sheets – we've printed up a bunch for this use.

Eventually the FCC (Walker) will have accepted radiation patterns for all of the commercially available antennas and all you will have to do is refer to the make and model – but for the present they want a lot more. The fact is that they have been rejecting some exhaustively prepared antenna submissions from manufacturers – and have refused to accept antenna patterns made by manufactuers even when these have been accepted by other divisions of the FCC.

This will probably change soon, but for the present the FCC seems to want you to set up your antenna and make field strength

measurements by driving around it as best you can. From this you can work out your horizontal radiation pattern. If you take the easy path and use a quarter wave ground plane on top of a tower – or a half wave dipole – the horizontal pattern will be circular and the gain one . . . 0 dB.

The effective radiated power is simple to calculate when the antenna gain is one. It is equal to the output of the transmitter (and tell them how you measured this – perhaps with a Bird wattmeter), less the losses in the coax cable, multiplied by the antenna gain. The *73 Coax Handbook* gives the coax cable loss vs frequency figures. If you're using RG-8/U foam, you can figure 2.3 dB loss per 100 feet at 147 MHz. So, if you have a ten watt repeater transmitter (measured with a Bird), and you lose 2.3 dB in the coax, and the antenna has a gain of one, your effective radiated power would be (according to the Coax Handbook again, page 13) 10 x 0.588 x 1 = 5.88 watts. Or perhaps you have 120 feet of coax, in which case you would have a 2.76 dB loss, or a power loss of .531 – so the ERP would be 5.3 watts. You're on your own.

Show your calculations of the loss of your feed line – in dB – and show how you determined the loss. If you used the Coax Handbook charts, reference them.

They want a polar coordinate graph paper radiation pattern of your repeater antenna as installed – showing true North – with the relative field strength indicated in voltage or dB and explain how this graph was prepared. They also want you to show the vertical field strength pattern. This may be a problem to measure – the FCC has suggested that you might turn the repeater antenna on its side and rotate it slowly, taking measurements every few degrees – or you might use a probe on a long stick – or you might get an airplane and fly around it at different altitudes. They will also accept, we understand, tests made on a model antenna at UHF, if you want to set up your own antenna laboratory.

Again, the easy way out is to use a quarter wave ground plane or a half wave dipole and get the pattern from a handbook (such as the *73 VHF Antenna Handbook*). They apparently will accept this.

The next hurdle is the remote control question. If there is any way to apply for your first license without remote control it will greatly simplify everything. Eventually we will have a body of literature of remote control systems which the FCC has accepted – but at present the ONLY known acceptable one is direct control of the repeater with no remote control.

It will not hurt you to show that your repeater has a three minute timer on it which will turn the repeater off when the transmitter has been on for three continuous minutes. This should be resettable only by the control operator. You can also have a timer set for less than three minutes on the input which is resettable by the users. The FCC would like to have a simple block diagram of the repeater system and you can indicate this control there. And don't forget to show the identifier too.

You should list the control operators, their calls and addresses, if any will be remotely controlling the repeater. We can't go into more details on remote control because it is just too complicated to handle in a short article and this will better wait until there have been some systems accepted.

So there you have it. If you follow the instructions given here you should be able to at least get your WR call in a reasonable time. Once you have it you can start work on getting remote systems accepted. There is much to be said for making the application as simple as possible and following "accepted" paths so you can get that WR call without a lot of correspondence with the FCC.

The latest reports are that the FCC has hired three more men to handle the repeater applications – the empire building has started. The overly complicated applications made it impossible for the existing staff to handle the paperwork. No reasonable explanation has been offered for the need for all this paperwork and it appears to many observers that no useful purpose is served other than expanding the FCC staff.

And don't forget the $9 when you send in the application.

. . .W2NSD/1

LOW TEMPERATURE TECHNIQUES FOR RADIO AMATEURS

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One of the most effective techniques for the reduction of front-end noise in receivers has been completely overlooked by radio amateurs. The reason for this neglect is that the technique, until recently, has been far beyond the financial grasp of most hobbyists. I refer to the low-temperature design.

The low-temperature situation, I am happy to say, has changed. Recent research and experimentation at W1GNZ has resulted in a simple, effective method of constructing a low-temperature front end that is entirely within the reach of the average amateur's pocketbook.

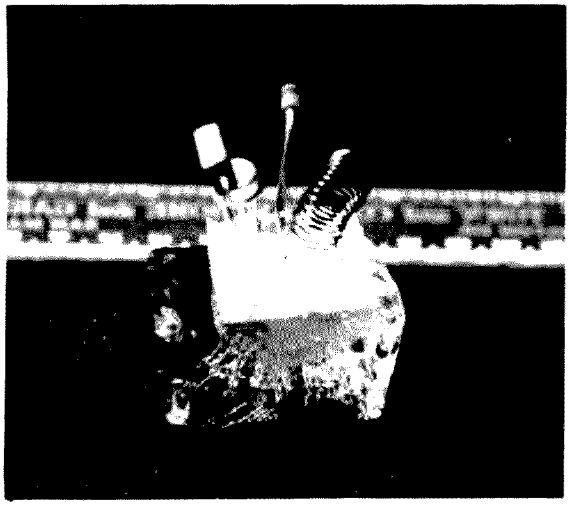
Before going into actual design details, however, let us take a brief look at the history of low-temperature design, and the theoretical underpinning so important to the present presentation. The theoretical details may present a slight problem for the average amateur, but it is hoped that all readers will at least make an attempt to plow through the mathematics. Certainly an appreciation of the *raison d ' être*, as it were, of super-cooling will enable the average amateur to derive full benefit from the design to be described.

Historical Significance

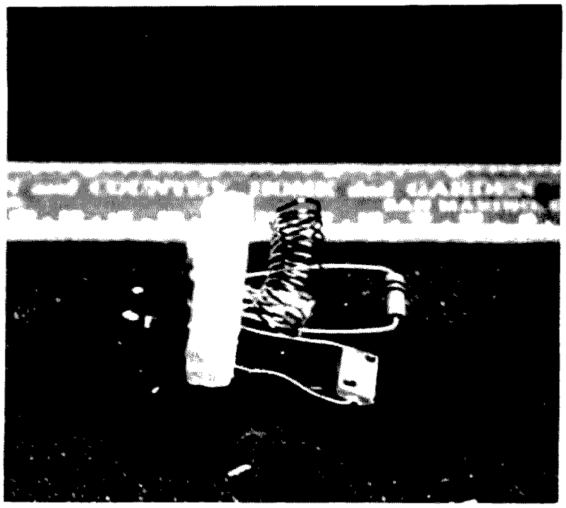
As most amateurs know, low-temperature techniques were first employed by radio astronomers in an effort to reduce thermal noise and attain the receiver sensitivity required to detect weak, extra-galactic sources. Authorities in this field have claimed overall sensitivities to the order of 10^{-5} microvolts for a 10 dB S/N radio. Compare *that* to your present receiver, OM!

We are pleased to report that a technique has been devised which places the low-temperature theory and practice within easy grasp. This article demonstrates the technique, along with a brief theoretical background.

The research described here has resulted in some interesting spin-offs, including a



The low-temperature preamplifier, with anti-heat sink.



Effect of connecting the preamp to the linear. Note decreased sensitivity.

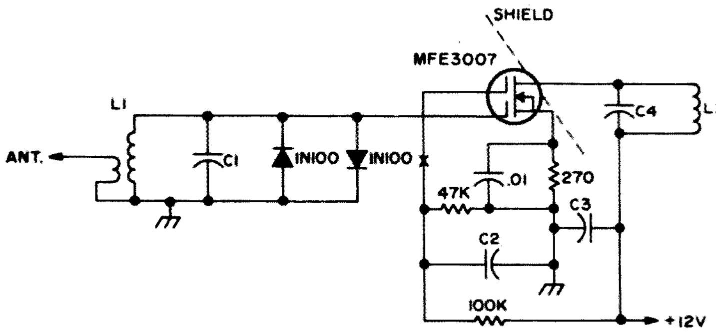


Fig. 1. A typical rf amplifier stage.

radical new organically-based i-f filter, which yields selectivity commensurate with the enhanced sensitivity. This will be described later.

Theoretical Background

We apologize for the use of mathematics here, but the development is such that the average amateur should have no trouble understanding the equations if he will put forth a little effort.

That receiver sensitivity is limited by thermal noise has been shown by River.[1] OM River's development makes extensive use of wave functions, flow equations and bridge networks, but in simplified form it looks like this:

$$\int X^2 dx^2 = EdQd\theta dY$$

$$m\frac{d^2y}{dt^2} + b\frac{dy}{dx} + ky = \left|\begin{matrix}0\\1\\\infty\end{matrix}\right\} \text{depending on sunspot cycle}$$

$$\left[p(r) + \frac{Bx^2}{8\pi} + \frac{B\phi^2}{8\pi}\right]_{r_1}^{r_2} + \frac{1}{4\pi}\int_{r_1}^{r_2} \frac{B\phi^2}{r}\,dr = to$$

$$\frac{Ro}{R}\log\left(\frac{Ro}{R}\right) = \frac{1}{to}\int_o^t F(t)\,dt$$

Therefore,

$$C = Nk\,(te^xe^4 - he^xe^4)$$ (the so-called "tee-hee" function)

This result can be simplified to the form: $a^2 + b^2 = c^2$

In words, the significance of this formulation can be stated thus: At room temperature, there is considerable molecular vibration in every element of an electronic circuit. Conservation of energy demands that the rf energy used in making the molecules dance[2] is not available as signal and the overall sensitivity of the circuit is reduced drastically. (Incidentally, this line of thought has borne fruit in recent medical studies.[3])

Experiments

The stage is now set for low-temperature design. Here at W1GNZ, a method was desired that would enable us to construct a low cost front end incorporating the above considerations. A trip to the junk box and a phone call to the city dump provided the necessary equipment and the project was begun. An old Kelvinator refrigerator was acquired and its cold path rerouted so there was a compartment near the top that remained at a fairly constant, cold temperature. This compartment would house the new front end.

Now, it may be argued that freon, as supplied by an ordinary refrigeration device, is not sufficient for super-cooling. This was found to be incorrect, for reasons that will be shown.

Once the cooling chamber was readied (we dubbed it the "ice box"), attention was turned to the construction of a suitable preamplifer. The circuit of an ordinary

1. His research efforts just keep rollin' along.

2. Most pronounced between 88–108 MHz.

3. Reuben, David. *Everything You Wanted to Know About Sex,* etc., Bantam Books. New York, 1969. See the chapter on sperm motility.

W1GNZ calculates a swr vs. cooking time plot for the unbalanced 10 meter cabbage.

preamp is shown in Fig. 1. Now, it must be remembered that at low temperatures resistance goes *down*, tending toward zero near zero degrees Kelvin[4]. The purpose of an rf stage transistor or tube is, of course, the amplification of the signal and the compensation for tuned circuit losses. A quick calculation of amplification factors and circuit losses revealed that, at low temperatures, the gain was high enough that certain simplifications could be made. The resulting low-temperature rf amplifier circuit is shown in schematic form in Fig. 2.

Results

The first attempt to test the completed project was made with the rf amplifier in the ice box, connected to our transceiver by a length of RG8/U. It was soon found, however, that extra gain was to be had by installing the *entire transceiver* in the ice box

Fig. 2. The rf stage used with the low-temperature apparatus.

4. Absolutely.

and operating it by remote control. Gloves are recommended for changing bands.

We were very excited when the rig was fired up for the first time. Since the predicted gain is so high in this circuit, antenna considerations were minimal. We used a cabbage that happened to be in the refrigerator.[5]

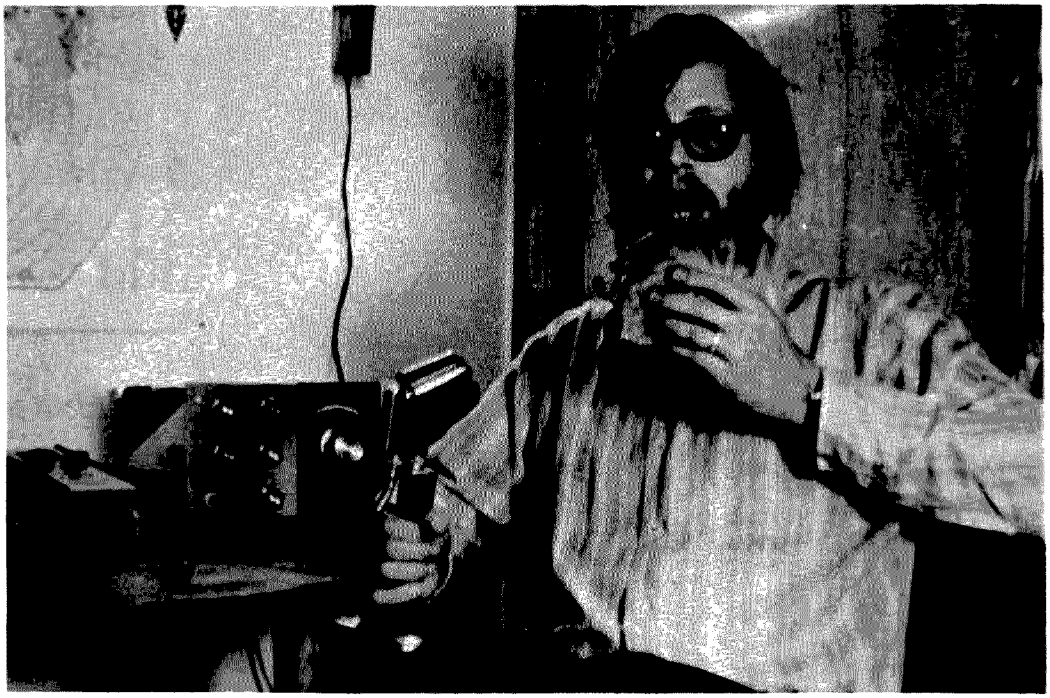
A number of contacts have been made with this system, with S9+ reports every time. Stations worked report a certain amount of Doppler shift (probably caused by the rapid slowing down of electrons when they hit the ice), but so far it hasn't slid us out of the band. Receiver gain is variable, and seems to be greatest with the defrost timer set on 4.

New Filter Discovered

As we mentioned at the outset, a spin-off of this research has resulted in the discovery of a radical, new organically-based filter.

After several hours of operation with the low-temperature system, it was noted that the selectivity had mysteriously improved. The observed bandwidth on SSB was indeed so narrow that only local bigots could be copied intelligibly. The device was opened

5. Peel off the outer leaves for a lower swr on ten meters.



5:1 is about right. Easy on the salt!

up, the beer cans shoved aside, and it was discovered that a mouse had inadvertently become wedged between the i-f stages. The poor creature had frozen solid, and was oscillating at a handy 50 kHz. No wonder the selectivity curve had such a long tail!

After further "cut and try" experiments with our new filter, we settled on a large field mouse for SSB and a smaller rodent for CW. This data indicates that a hamster may have to be substituted for SSTV, but it hasn't been tried so far.

An inside view of the complete installation.

Some Problems

No truly meaningful research is ever completed without difficulties of some sort. After a few weeks of operating we looked at the W1GNZ log and discovered that contacts had been made only with antarctic research stations; weak, extra-galactic sources, and an occasional VE8. Further investigation is indicated here. Additionally, the refrigerator needs to be defrosted about once a month and the mouse replaced. Failure to replace the mouse, we've found, results in a tremendous amount of "slop" in the received signal.

Conclusion

We think this article shows that the average amateur is missing out on a lot in his hobby if he does not experiment and attempt new ways of doing things. The fun one can have with the equipment described here is limitless. For instance, the lower part of the refrigerator can be used to get rid of annoying operating distractions such as small children!

In a forthcoming article we will describe our recent venture into radio controlled mouse farming. Meanwhile, does anybody know a good cabbage wholesaler?

. . .W1GNZ

Wayne Green W2NSD/1
Editor-Publisher

CHOOSING YOUR FM RIG

The chart shows the basic specs of 32 different amateur two meter FM transceivers – and the question naturally arises: how do you decide which rig is the best for you?

This is a pretty tough order, frankly, and you'll find political and religious arguments about as easy to settle if you consult friends. This does not mean that it is impossible to apply rules of logic to your selection, only that it may appear that few FMers do.

One easy sort can be applied to the list if you have a need for a hand unit rather than a mobile rig – this takes you to the Standard 146A and the Tempo (Henry) FMH units directly, without passing go – and with the payment of $200 or so. You may want to count in the price of fast charge nicad batteries with these units – plus a charger to keep the unit in when not in hand. This will bring the net cost of the hand units a bit higher.

Both of these units put out two watts, which runs down the batteries a lot faster than may make you happy. There is something to be said for the earlier SR-C146 unit which ran only one watt out – and lasted a lot longer. It might be prudent to consult the importers, should you get one of these units, about reducing the power to one watt or a bit less. The results will not be noticeably different under most circumstances.

Perhaps you want to invest in a low priced unit which can be used both as a hand unit and a mobile rig – in which case you'd better check the three available portable units, the Drake TR-22, the Tempo FMP, and the new Gladding 660. The TR-22 has a built in charger, while the FMP has a socket to plug in the Johnson charger. The TR-22

		Model	Price	Power	Channels	S-Meter	First Year Sold
Clegg		27B	$480	25	All		73
Comcraft		CTR144	$490	8	All	X	71
Drake	P	TR-22*	$200	1	6	X	71
		TR-72*	$300	10-1	23	X	73
Genave		GTX-2	$250	30	10		72
Gladding	P	660	$200	6-1	6		73
		25	$250	25-1	6		71
Heath		HW202	$180	10	6	X	73
Inoue		IC-20*	$270	10-1	12	X	72
		IC-21*	$359	10-1	24	X	72
		IC-22*	$300	10	22	X	73
Midland		13-500*	$250	15-1	12	X	73
Regency		HR2MS	$319	15	8R,6T		72
		HR212	$259	20	12		72
		HR2A	$229	15	6		72
Ross & White		RW-BND*	$240	10	12	X	71
SBE		SB144*	$260	10	12	X	71
Simpson		B	$250	25	12		71
		A	$180	10	4		71
Sonar		3602	$400	–	–		72
		3601	$300	10	8		71
	H	2307	$450	1	5		71
Standard		826MA*	$370	10	12	X	72
	H	126A*	$290	2	5	X	72
		14 *	$595	10-3-1	22	X	72
Swan		FM2X*	$260	10	12	X	71
		FM1210H*	$330	10	12	X	72
Tempo	P	FMP*	$225	3-½	8	X	71
		FMV2*	$200	10	11	X	72
	H	FMH*	$190	2	6	X	72
		CL146*	$279	10-3	12	X	73
Yaesu		Auto FT2*	$330	10-1	8	X	72
		FT2FB*	$230	10-1	12	X	72

* of Japanese manufacture
H = Hand-Held, P = Portable. All others mobile units.

runs one watt output, the FMP 3 or ½ watt, which can be handy. You normally run the low power and then have the ability to increase your signal by a bit over one S-unit if you need it. Either rig can be used with a mobile power amplifier to give you a combination shoulder rig and mobile rig. If you can't afford both hand units and mobile rigs, this is a money saver. And the chances are that you will find plenty of opportunity to use a hand unit – most of us do.

The mobile rigs can be divided up a bit. First there is the Clegg, which is in a category all its own. This is the only rig that will hit every channel from 146–148 MHz. The calibration is accurate enough for you to set the knobs and work simplex or through any repeater. It costs a bit more, but it is going first class.

The Comcraft is different. It is an AM-FM rig with a tunable receiver and a VFO for the transmitter. The dial calibration is not adequate for repeater use, though the spot switch permits simplex operation. You really need a frequency counter with this unit if you are going to work through very many repeaters. There is a crystal socket on the front panel which can be used if you don't mind plugging in crystals to hit the repeaters. You still have to tune for the received signal. This is a terrific rig if there is much AM in your area – and with a counter it does about anything you could ask.

All the rest of the rigs are crystal controlled for both transmitter and receiver. In general you get about what you pay for – with higher prices generally indicating better receiver selectivity. It is possible to improve selectivity on most sets by buying a better filter for the i-f. This takes a bit of doing on some sets, but is worth the effort if you have a problem with adjacent channel spillover. Most of the newer sets are coming through with pretty good filters – the "D" at least, and some with the "E." These are by Murata.

Poor i-f selectivity makes it so receivers have a tough time rejecting a strong repeater in the next channel. Thus, a very strong signal on 146.91 can wipe out repeaters on 146.88 and 146.94.

Another factor which may be of importance to you is the number of channels in a rig. If you are in the northeast you may think in terms of one of the 20+ channel rigs such as the TR-72, the new Drake rig – the Inoue IC-21, or the Standard 14U. The IC-22 should be available in a short while, with its 22 channels.

If price is a major factor, you will be interested in the new Heath HW-202 at $180 or, if there are still any left, the Simpson Model A at the same price – both remarkable buys. The Simpson boards, the last we heard, are being used as the foundation for the Dycomm repeater.

If power output is your turn on, then you may want to go the Genave GTX-2 with 30 watts output – the Gladding 25 with 25 watts – or the Simpson Model B with 25 watts – all priced at about $250. Each has its pluses, with the Simpson and the Gladding having front speakers, which are generally a lot easier to hear in the car unless you plug in a separate speaker. The Simpson has 23 channels, the Genave 10, and the Gladding six.

. . .W2NSD/1

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EUROPE ON 2 METERS 'A' DAY

Complete details on reciprocal licensing and 2 meter repeater coverage.

Taking along an amateur radio station on vacation, especially to a foreign country, used to be a luxury affordable only by a limited number of amateurs. However, the advent of reciprocal licensing with many foreign countries and the buildup of 2 meter repeaters have changed all that. With a compact transistorized 2 meter transceiver in your suitcase, you have a unique opportunity to quickly establish contact with the local amateurs in a foreign locale. The usage of a special call sign adds a bit of DX flavor to such operation, and local foreign amateurs – happy to hear an unusual call sign over their repeater – will usually extend a warm welcome. As long as you don't overdo it by forgetting that you are still a guest in a foreign country, you can have a great deal of fun and establish many new relationships.

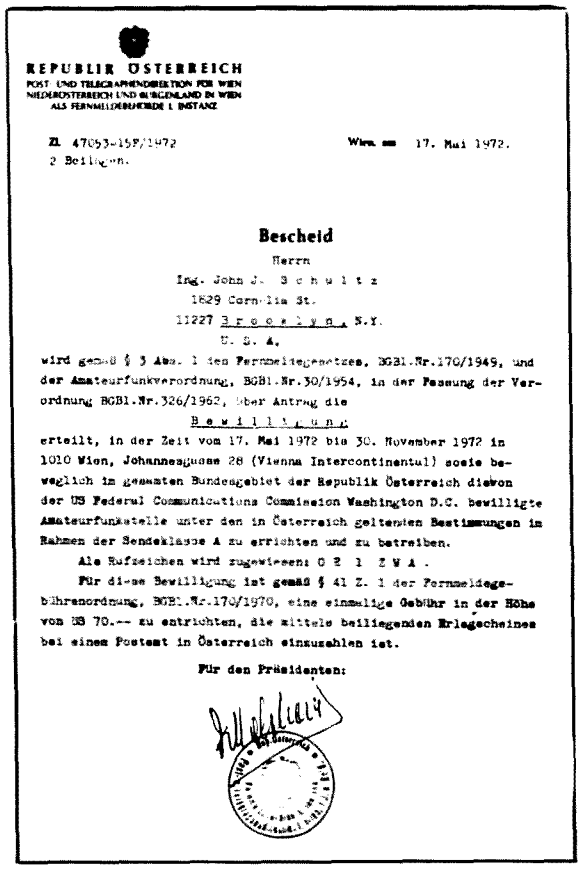
Two items are obviously involved: securing the necessary license for operation in a foreign country and knowing the operating frequencies of the foreign repeaters. These items are covered in detail in this article, plus some general operating advice. Only the European area is covered because it offers the best possibilities for 2 meter repeater operation and most foreign travel is done there.

As part of the "homework" necessary to gather the information, letters were sent to all the licensing authorities from various countries as well as to many radio clubs. Many cordial replies were received in English as well as French, Spanish, etc. Obviously some administrations preferred to deal in their own language, while others were kind enough to respond in the same language as the inquiry. Such a situation doesn't present too many problems, but you should be prepared to deal with forms where some translation assistance may be required. These situations are noted in the following material.

An alphabetical listing follows which discusses for each country the procedure for obtaining a temporary license and the 2 meter activity.

Austria

Temporary licensing is very efficiently handled by Walter Nowakowski OE1WN. Walter is an official of the Austrian Association of Radio Clubs and handles matters dealing with temporary licensing with the government telecommunications authorities. To obtain a temporary license one has to fill out (in English) a simple form which he furnishes, supply a photostat of one's U.S. license and pay a nominal fee. The fee depends upon the maximum plate or collector dissipation (not the input power) of the final stage in the rig. For dissipations below 25 watts, the fee is a very reasonable 50 cents a month for the temporary license! Send 5 IRC's to cover mailing costs. The form for the application calls for an address in Austria and this must be supplied. There is no need to specify every address in Austria where one will be staying, but the main address should be indicated, as this will



REPUBLIK ÖSTERREICH
POST- UND TELEGRAPHENDIREKTION FÜR WIEN
NIEDERÖSTERREICH UND BURGENLAND IN WIEN
ALS FERNMELDEBEHÖRDE I. INSTANZ

Zl. 47053-15F/1972 Wien, am 17. Mai 1972.
2 Beilagen.

Bescheid

Herrn
Ing. John J. S c h u l t z
1829 Cornelia St.
11227 B r o o k l y n , N.Y.
U. S. A.

wird gemäß § 3 Abs. 1 des Fernmeldegesetzes, BGBl.Nr.170/1949, und der Amateurfunkverordnung, BGBl.Nr.30/1954, in der Fassung der Verordnung BGBl.Nr.326/1962, über Antrag die

B e w i l l i g u n g

erteilt, in der Zeit vom 17. Mai 1972 bis 30. November 1972 in 1010 Wien, Johannesgasse 28 (Vienna Intercontinental) sowie beweglich im gesamten Bundesgebiet der Republik Österreich die von der US Federal Communications Commission Washington D.C. bewilligte Amateurfunkstelle unter den in Österreich geltenden Bestimmungen im Rahmen der Sendeklasse A zu errichten und zu betreiben.

Als Rufzeichen wird zugewiesen: O E 1 Z W A .

Für diese Bewilligung ist gemäß § 41 Z. 1 der Fernmeldegebührenordnung, BGBl.Nr.170/1970, eine einmalige Gebühr in der Höhe von S 70.-- zu entrichten, die mittels beiliegenden Erlagscheines bei einem Postamt in Österreich einzuzahlen ist.

Für den Präsidenten:

W2EEY's temporary Austrian operating permit.

determine the number in the call sign received (OE1, OE2, etc.). Contact:

Ing. Walter Nowakowski OE1WN
Froebelgasse 46/18
A-1160 Vienna, Austria

2 Meter repeaters in Austria have gotten off to a slower start than in neighboring Germany but have been growing steadily in number. The following should be in operation by mid-'73:

Input	Output	Location
144.15	145.75	Innsbruck
144.15	145.75	Gmunden
144.15	145.75	Vienna (city)
144.20	145.80	St. Poelten
144.20	145.80	Klagenfurt
144.20	145.80	Kufstein
144.25	145.85	Linz
144.30	145.70	Mattighofen
144.35	145.65	Schladming

Simplex 145.000 and 145.150

Belgium

Since 1964 Belgium has been granting temporary licenses to visiting amateurs even

if the country from which the visitor comes DOES NOT grant reciprocity to Belgium amateurs. This fine gesture is indicative of the warm welcome Belgium extends to visitors. To obtain a temporary license, write first to Rene Vanmuysen ON4VY for an information sheet which describes the application procedure to obtain a temporary ON8 call. There is no form to fill out but one has to supply the information requested on the sheet directly to the government telecommunications authorities at the address given in the sheet. In general, the information needed is the same as required in all temporary license applications (identification information, license photostat, temporary address, etc.). The only thing extra the Belgium authorities want is a circuit diagram (photostat from an instruction manual will do) of one's transmitter final stage showing the input voltages and current and type identification for commercial equipment. There is a license tax fee of about $1.50 and a 30 cent/month fee for each month a license is desired (for up to 125 watts input). Contact:

Rene A. Venmuysen ON4VY
General Councillor of U.B.A.
Diepestreet 52
1970 Wezembeek - Oppem, Belgium

Repeaters on 2 meters have been planned for installation throughout the major areas of Belgium but are not yet in operation. The following is the planned 2 meter repeater network which hopefully will be in operation by mid 1973: 145.000 is the general simplex calling frequency but note there is also a simplex channel associated with each repeater!

Input Output	Location	Simplex
145:050–145.650	Flandre et Liege	145.575
145.100–145.700	Namur et Flandre	145.625
145.200–145.800	Anvers et Luxembourg	145.550
145.150–145.750	Hainant et Limbourg	145.525
145.225–145.825	Brabant	145.600

Denmark

The telecommunications authorities have responded that they are, unfortunately, "for the time being" unable to issue temporary licenses to U.S. amateurs. This situation is unlikely to change during 1973. For a quick check before departure, write to:

Ministry of Transport and Communications
Telecommunications Services
Farvergade 17
DK-1007 Copenhagen K, Denmark

The above information is sad to report especially since Denmark has a fairly good network of 2 meter repeaters. At least 18 repeaters are presently licensed to give fairly complete geographical coverage of the country. The channels used are of two spacings, 600 kHz and 1600 kHz.

600 kHz spaced channels
144.950–145.550
145.050–145.650
145.150–145.750
145.250–145.850

1600 kHz spaced channels
144.150–145.750
144.250–145.850

For the 600 kHz channels, simultaneous tones at 1400 and 2200 Hz are necessary to open the repeaters. For 1600 kHz channels, a single tone of 1750 Hz is needed. At last report, Copenhagen was on 145.250–145.850.

Finland

This country does issue temporary licenses to U.S. amateurs for periods of 1–3 months. However, mobile operation is not allowed with such a license. The details for securing the license are handled by the national radio club organization which apparently has a nice arrangement with the government since one has to join the radio club if a temporary license that is valid for more than one month is to be secured. The fees are quite nominal. If a license good for one month is secured, the cost is Fmk 15.20 plus Fmk 10.00 handling fee. For a longer term license the cost includes Fmk 10.00 handling fee, Fmk 15.20 basic license fee and Fmk 35.00 for a year's membership in the radio league! The application form for the license is easy to fill out with no complications, except that an exact address from which one will be operating in Finland must be supplied, and a photocopy of the identity information pages in one's passport. The call sign to be used is the home call plus suffix indicating the OH district in Finland (for example, W3EEY/OH2). 2 meter operation is carried on in Finland but there are no repeaters in operation at present. The radio league does hope to start a repeater network in 1973 but they could not supply any possible frequency information as yet. The address of the radio league is:

SRAL
Box 306
00101 Helsinki 10, Finland

France

Two inquiries well over a month apart were made to the address the I.A.R.U. supplied as the authorities for reciprocal licensing matters. No reply was ever received. Perhaps the inquiry has to be made in French? In any case, it does not matter much as there are no known 2 meter repeaters in operation in France. For those who would like to try their luck in contacting the telecommunications authorities, the address is:

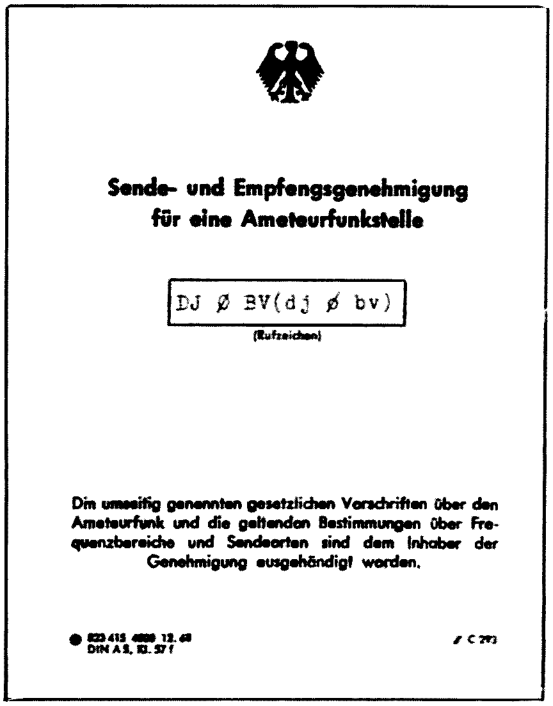
Direction des Services
Radio Electriques
5 Rue Froidevaux
Paris 14, France

Germany

The German Radio Club (DARC), via Diethelm Burberg DJ2YE, handles all details for the temporary licensing of foreign amateurs. There is no form to be filled out but the information requested on an information sheet supplied by DJ2YE must be supplied. A basic 3 month temporary license is issued for about $3.50 even if the stay is for a shorter period. One uses his regular call

followed by /DL. Technician Class licenses can apply to operate on 2 meters and Novice licenses are not recognized. An English version of the German operating regulations which describes log keeping requirements, etc., is sent with the temporary license.

Diethelm Burberg DJ2YE
P.O. Box 180
D-4020 Mettmann, Germany



**Sende- und Empfangsgenehmigung
für eine Amateurfunkstelle**

DJ Ø BV(dj ø bv)
(Rufzeichen)

Die umseitig genannten gesetzlichen Vorschriften über den Amateurfunk und die geltenden Bestimmungen über Frequenzbereiche und Sendearten sind dem Inhaber der Genehmigung ausgehändigt worden.

Standard amateur license issued by the West German authorities.

145.000 and 145.150 are in wide use as the simplex calling frequencies in Germany. Germany undoubtedly has the most developed 2 meter repeater network in Europe. Most of the repeaters operate with 1.4 or 1.6 MHz separation, although an eventual changeover to 600 kHz separation is planned. There will be no major changeover during 1973, although a few experimental repeaters will be operating on 600 kHz spacing (designed as "I" channels in the listing below). There first follows a listing of the in/out frequencies associated with each channel designation and then a listing of the repeaters by location.

Channel	Input Output
12	145.050–145.650
13	145.075–145.675
R2	144.150–145.750
R3	144.175–145.775
R4	144.200–145.800
R5	144.225–145.825
R6	144.250–145.850
R7	144.275–145.725
R8	144.300–145.700

Channel	Location
12	Feldberg/Taunus
13	Nordhelle/Sauerland
13	Hoechenschwand/Hochschwarzw.
R2	Berlin/Funkturm
R2	Cham
R2	Coburg
R2	Doerenberg/Osnabrueck
R2	Duisburg
R2	Feldberg/Taunus
R2	Hamburg
R2	Hannover
R2	Kaiserstuhl (Freiburg)
R2	Kassel
R2	Konstanz
R2	Muenchen-Stadt
R2	Nuernberg
R2	Oldenburg
R2	Stuttgart
R3	Bad Koenig
R3	Bocksberg (Harz)
R3	Bredstedt
R3	Fulda
R3	Goeppingen
R3	Hagen/Westf.
R3	Karlsruhe
R3	Koeln-Stadt
R3	Trier
R4	Aachen
R4	Augsburg
R4	Bad Hersfeld
R4	Baederstrasse (Ostsee)
R4	Bamberg
R4	Bentheim-Lingen
R4	Bremerhaven
R4	Darmstadt
R4	Deggendorf
R4	Deister
R4	Dortmund–Schwerte
R4	Dreilaendereck (Loerrach)
R4	Grab

R4	Greding
R4	Homberg-Kaiserslautern
R4	Koblenz
R4	Leer/Ostfriesland
R4	Lindau-Northeim (Hann.)
R4	Luechow/Elbe
R4	Siegen
R4	Triberg
R4	Weiden
R5	Berlin-Neukoelln
R5	Essen
R5	Frankfurt-Stadt
R5	Hoher Meissner
R5	Ochsenwang
R5	Pforzheim
R5	Pirmasens
R6	Aschberg (Rendsburg)
R6	Bergheim
R6	Bremen
R6	Detmold
R6	Goslar-Steinberg
R6	Heidelberg
R6	Hoechsten (Oberschwaven)
R6	Knuell
R6	Lahr
R6	Merzig/Saar
R6	Muenster/Westf.
R6	Ochsenkopf
R6	Winterberg
R6	Wuerzburg
R7	Zugspitze (Bavaria)
R8	Altenwalde
R8	Kalmit
R8	Ludwigsburg

Ireland

This country extends a friendly welcome to U.S. amateurs who can operate there on a reciprocal basis with a minimum of formality. No special application form is required for a temporary license. One only has to supply along with a photostat of the U.S. license a "listing of the frequency bands, power, modes of emission, duration of stay and exact location of operation." No fee is charged for a temporary license good for up to one month. All classes of U.S. licenses are recognized except for the Novice and Technician Classes.

Unfortunately, in spite of the relatively simple procedures for obtaining a temporary license in Ireland, there is not too much incentive for the 2 meter enthusiast to do so. There is very little activity in the 144–146 MHz 2 meter band there. The main VHF operation is confined to the 4 meter band with 70.26 MHz as the main calling frequency. On 2 meters, 145.11 is used as a calling frequency particularly for SSB, while 145.3 and 145.6 serve as less commonly used general calling frequencies.

The address to apply to for a temporary license is:

Secretary
Dept. of Posts and Telegraphs
Marlborough St.
Dublin 1, Ireland

Italy

There is as yet no reciprocal licensing arrangement with Italy although it is rumored that in 1973 Italy will conclude some arrangement with other European countries (what happened to U.S. interest in taking

Unique Italian "Patente" second-operator license is good for life.

part in these negotiations?). However, the country does make available to any foreign amateur a so-called "Patente" which is a rather unique second operator license good for life. With the "Patente" one can legally operate any licensed Italian amateur radio station much like the station licensee can. The form to apply for the "Patente" must be filed with the telecommunications authorities in Italian. The Italian Radio Club, through the good offices of Anacleto I2RCD, has volunteered to do the necessary paper work once the information and necessary fees (about $7) are supplied to him. The information required is similar to that of other countries, with two exceptions. Two passport size photographs which have been authenticated by an "official" must be supplied. The official apparently can be the local police, State Dept., etc. One must also supply a copy of a birth certificate or similar document proving identity (a photostat of a passport is mentioned, but I don't think it is legal for U.S. citizens to make such a copy). I2RCD's address is:

Anacleto Realini I2RCD
Via Rimini 13
20142 Milano, Italy

Luxembourg

A temporary license can be obtained free of charge for periods of less than 30 days. One's U.S. call is used followed by the suffix /LX. The usual information must be supplied regarding personal identification, U.S. license status, etc. However, there is no application form as such and it appears that the correspondence with the authorities must be carried out in French. The maximum plate/collector dissipation allowed in the transmitter used is 100 watts.

Although 144 to 146 MHz is in use in Luxembourg, no information could be obtained regarding the existence of any repeaters.

For details of temporary licensing, contact:

Direction des Postes
et Telecommunications
Section Telecommunications
8a, Avenue Monterey
Luxembourg

Netherlands

It was rather surprising not to receive a reply to two inquiries about reciprocal licensing directed to the office listed by the I.A.R.U. Some two meter activity is definitely going on in the country but details could not be obtained. The office to write to is:

Radio Control Service, P.T.T.
Kortenaerkade 12
Gravenhage, Netherlands

Portugal

This country definitely issues reciprocal licenses to U.S. amateurs. I know several U.S. amateurs who have secured such licenses. However, in each case these amateurs were residing in Portugal at the time they secured the licenses. Two mail inquiries to the authorities in Portugal about reciprocal licensing produced absolutely no reply, although over two months was allowed for a reply to arrive. So the situation remains unclear. In any case, there is very little 2 meter activity in Portugal and no repeaters are in operation. The address of the reciprocal licensing contact office in Portugal is:

Rede dos Emissores Portugueses
Rua D. Pedro V-7-4
Lisboa 2, Portugal

Spain

There is as yet no reciprocal licensing agreement between Spain and the U.S., although Spain does have such arrangements with other countries. An inquiry to the U.S. Embassy in Madrid produced only the result that the matter is "under discussion." The main reason that seems to be given for the lack of temporary licensing of U.S. amateurs visiting Spain is that Spanish amateurs residing in North America are not accorded operating privileges. It would seem that a bit of a "push" in the right places could get this situation off dead center and secure temporary licenses for U.S. amateurs visiting this beautiful country. Spanish radio amateurs, judging from the few I have had contact with, are eager to extend a warm welcome to

visiting U.S. amateurs. Write your Congressman!

Sweden

This country does issue reciprocal licenses to U.S. amateurs. No fee is charged for the issuance of a temporary license valid for 30 days or less. The call sign used would be the regular U.S. call followed by /SM and then followed by a digit indicating the region in Sweden from which one is operating. A listing of the regions is furnished with the temporary license. The application form for a temporary license is obtained directly from the telecommunications authorities and is quite easy to fill out (in English). It would appear that at least for 2 meter operation all classes of licenses are recognized except Novice class. There are only two "unusual" requirements imposed by the authorities which require a bit of advance preparation. One is that a copy be furnished of one's U.S. license if issued not more than six months ago, or if the license was issued more than six months ago, a certificate from the FCC stating the license is still valid. The second requirement is a certificate of "good conduct" issued either by one's "police authorities" or by the "applicant's amateur radio organization." So, I suppose that reads: be good to your local police chief or pay your club dues! Seriously, these are valid requirements and should be respected.

Sweden has a nicely developed network of 2 meter repeaters operating throughout the country. The following is a list of presently active repeaters:

Input	Output	Location
144.900	145.800	Stockholm
145.050	145.650	Stockholm
145.050	145.650	Bollnäs
145.200	145.800	Sundsvall
145.200	145.650	Göteberg
145.050	145.650	Helseingborg
145.200	145.800	Ystad
145.150	145.750	Karlskrona
145.200	145.800	Kalmar

A tone burst at 2172 Hz is necessary to activate some of the repeaters.

Switzerland

U.S. amateurs may apply directly to the Swiss telecommunications authorities for a temporary license with a Swiss call sign. A simple application form has to be filled out (although it is written only in German, French and Italian) and returned with a photostat of one's U.S. license and a fee in Swiss Francs equivalent to about $10. The temporary license is good for three months. Write for the application form to:

General Directorate of PTT
Radio and Television Division
CH-3000 Bern, Switzerland

Switzerland has only recently allowed the licensing of 2 meter repeaters and there will probably be a number of repeaters coming into service in the next year. The only repeater presently in operation is one near Lugano with in/out frequency of 144.150 and 145.750. A second will be in operation near Bern in 1973 although the frequencies have not yet been established. 145.000 is in common use as the 2 meter mobile calling frequency.

United Kingdom

One must deal directly with the Ministry of Posts and Telecommunications to obtain a temporary license. An application form must be obtained and returned with the necessary information. Basically, temporary licenses are issued for up to a three month period and cost about $7.50. Only Conditional, General, Advanced and Extra Class licenses are recognized for the issurance of a temporary license. The application form calls for details of one's passport number, etc., and so this must be obtained before making out the application. The address of the office to contact is:

Ministry of Posts and Telecommunications
Radio Regulatory Division
Waterloo Bridge House
Waterloo Road
London SE 1 8UA, England

145.000 is in common use as the country wide simplex calling channel. The only

repeater licensed to operate as yet is one near Oxford with in/out frequencies of 145.150 and 145.750. British amateurs are pushing hard for the establishment of other repeaters but the only thing that can be said with certainty is that the government has licensed this one 2 meter repeater to operate on an experimental basis until August 11, 1973. Other channels which may be of interest are:

144.350	Southwest and South Wales calling channel
144.480	FM calling channel, London area
144.800	FM working channel
145.200	FM working channel

Overall Do's and Don'ts When Applying

Allow sufficient time for processing of the license. It would be best to apply several months in advance although some countries such as Switzerland indicate a month ahead is sufficient. Don't expect to arrive in a country and apply then for a license (unless a stay of several months is anticipated). Except for special events, the licensing authorities are not set up for "counter service" on license applications.

When dealing with amateurs who are contact personnel for their governments rather than with the government office directly, remember that postage costs come out of the treasury and pockets of the radio club. Enclose some IRC's.

When sending the fees required, try to send the exact fee in the currency of the country. This requires a bit more work on your part but will definitely speed the processing of your license. Especially when dealing directly with a government office, exact fee payments are necessary to keep their computers happy.

Don't apply for a license unless you have some serious intention of using it. The low fee requirements of some countries may tempt one to apply "just in case" but it is a disservice to those who have to process the paper work.

Equipment and Operating Practices

Tone requirements for repeater installations have generally not been listed separately because in practice tone is only needed for initial turn on and then the repeaters remain carrier operated. Good practice is to listen first to see what the operating procedures are on a given repeater, so a tone burst unit is not an absolute necessity. However, if such a unit is desired, one will find 1750 Hz to be the most commonly needed frequency. 2125 Hz is also used by a few repeaters.

Customs on a small transceiver being temporarily imported into a country is generally not a problem as long as one has a valid temporary operators license. One should, however, have either an original purchase bill for the equipment or a listing of the serial number, purchase price and other identification details. At the worst, one may be required to post a temporary import bond equal to 25 to 50% of the listed value of the equipment which is then later refunded upon leaving. Placing the transceiver in the checked baggage on an airline flight will avoid a lot of questions as compared to carrying the transceiver as carry-on baggage since the latter is usually still searched at European airports. European policemen also tend to be much more curious about people with radio gear since CB operation does not exist in most countries. When operating portable and in public be sure your licensing papers as well as personal identification papers are not back in the hotel room.

A small portable antenna is a great asset to any transceiver rather than relying on a whip. Some very handy forms of a portable ground plane and dipole can be built using properly cut up sections of a metal measuring band and a few banana plugs and jacks. RG 174 miniature coax is handy to use and the loss not excessive for runs up to 7 to 8 feet.

Finally, as a visitor, one will usually find a warm welcome on European repeaters and many of the local repeater users would like to collect a W QSL. Phone patches and message handling are not allowed on European repeaters. Don't monopolize the repeater time. Stop after every few QSO's and disappear for a while. Enjoy the repeaters as a visitor.

. . .W2EEY

Charles Durst WA4WTX
4407 Sunny Court
Durham NC 27705

SCANNING ADAPTER FOR FM TRANSCEIVERS

A four channel commercial type FM mobile would be much more versatile if independent selection of transmit and receive frequencies were possible. However, if the unit is trunk mounted and connected by the cable supplied by the manufacturer, there probably are not enough wires in the cable for independent selection. Not wanting to run additional wires under the carpet and seats of the car, the circuit in Fig. 1 was designed to provide eight combinations of the four transmit and receive frequencies and in addition scan the receive frequencies. This can be done digitally with the four wires used for the four original channels. The same circuit could scan eight receive channels as well as enable manual selection of any channel.

Basic Theory

The heart of the selection circuit is an SN7442 BCD to Decimal Decoder. A switch in the control head can be wired to count in Binary Coded Decimal format (see Fig. 2). For each count in BCD format a single output on the SN7442 goes to ground, "0," while all other outputs remain at 5 volts, "1.' The outputs can be inverted and used to drive transistor switches which can ground cathodes or emitters for frequency selection.

Scanning

It was readily apparent that a BCD counter could perform the same function as turning the channel selector switch, only much faster and easier. A unijunction tran-

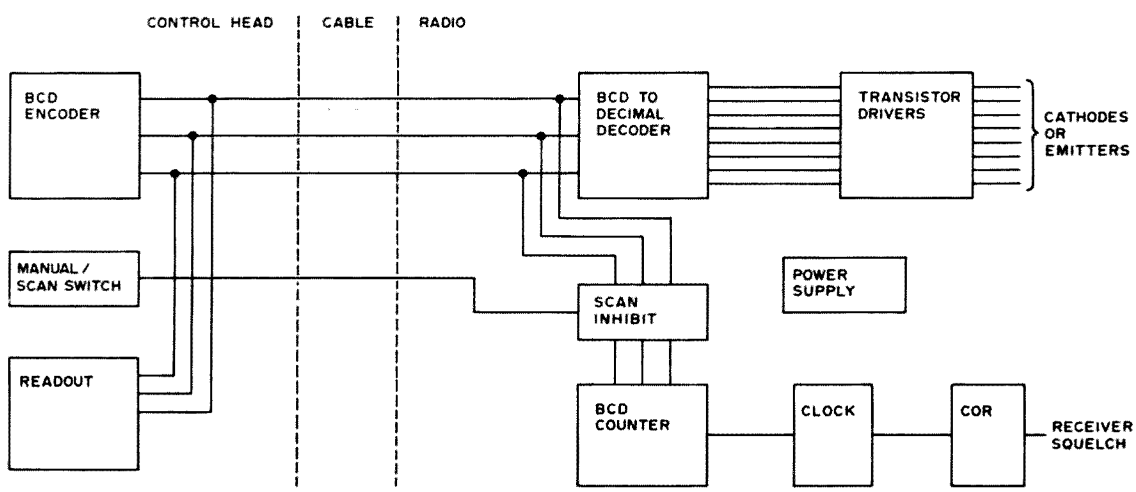


Fig. 1. Block diagram of channel selector — scanner.

BINARY CODED DECIMAL CBA	*Channel Count*	*DECIMAL* Actual Count
000	1	0
001	2	1
010	3	2
011	4	3
100	5	4
101	6	5
110	7	6
111	8	7

Fig. 2. BCD to decimal conversion.

sistor clock steps the SN7493 BCD counter through its sequence to drive the BCD to decimal decoder. A COR type circuit stops the clock when a signal is received. Scanning is resumed when no signal is present.

System Schematic

Figure 3 shows the complete schematic of the scanner and selection circuit. A description of each block of Fig. 1 will be related to the schematic in Fig. 3.

BCD Encoder

An eight position, four section, shorting type rotary switch can be used to generate the BCD codes in Fig. 2. Ground can supply the "0" condition while 2K pull up resistors connected to 5 volts provide the "1" condition. A ground is applied to the

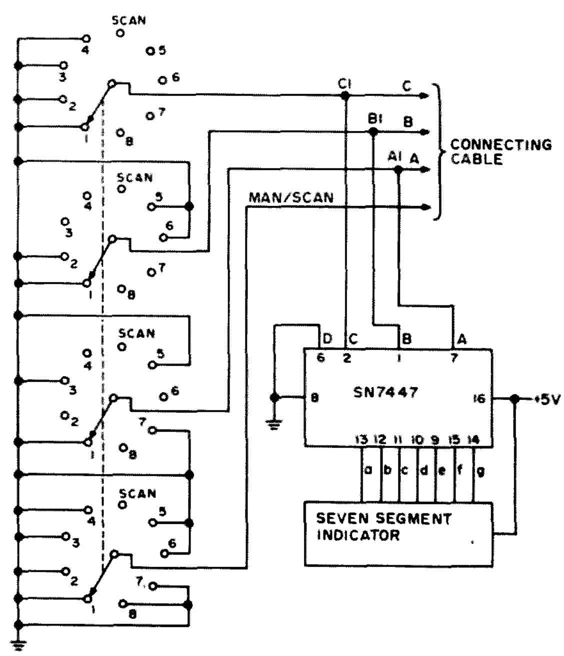


Fig. 3a. The scanner "control head" circuitry that connects to Fig. 3b via the connecting cable. See block diagram in Fig. 1 for its functions.

Scan-Inhibit line to manually select a channel. The channels are scanned when no ground is on the Inhibit line.

Readout

Many methods are available for reading out the received frequency. In all cases the BCD format must be decoded to the desired output. In Fig. 3a, a BCD to seven segment decoder-driver operates a Numitron or similar seven segment readout device. This will indicate zero through seven. A BCD to Nixie decoder-driver could drive a Nixie tube to read one through eight. Alternately a BCD to decimal decoder could be used with transistor drivers to turn on a light bulb corresponding to the appropriate channel. See Fig. 4. Ultimately a matrix or programmable read only memory could drive two readout devices to indicate the frequency such as 52 or 94.

BCD To Decimal Decoder

The SN7442 accepts Binary Coded Decimal format, and a single output goes to ground from 5 volts for the appropriate input. Only one output is at ground at a time; all others are at 5 volts.

Transistor Drivers

The configuration of the transistor driver circuit depends on the number or combination of channels. The circuit in Fig. 3 creates eight different combinations of four transmit and four receive frequencies. The transistors could be wired to select any

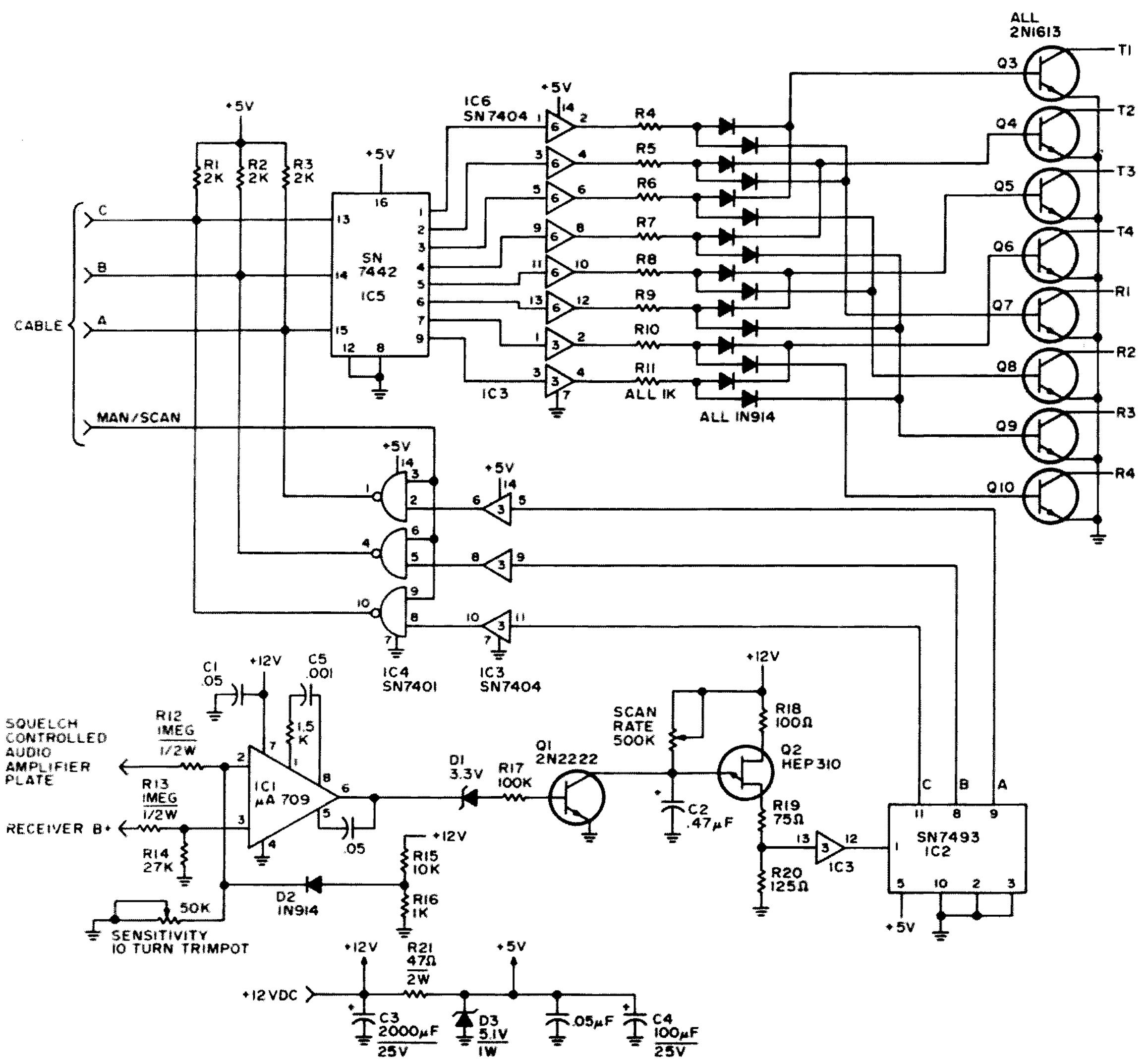


Fig. 3b. The main circuitry of the scanner. All resistors are 1/4 Watt except as noted.

Junk Box Panel Bushing

A very serviceable panel bushing can be made from a defective volume control. The conversion is simple. First, loosen the tabs holding the cover and slide it off the back. The switch assembly, if it has one, will come off at the same time. Remove the clip which holds the shaft in place. This is done by pulling outward on the shaft and simultaneously inserting a knife blade between the threaded shank and the clip. Twist slightly and the clip will come out of its recess. The shaft may now be removed through the rear of the control. Break off the fiber disc upon which the resistance element is deposited and you have an excellent panel bushing equivalent to the best on the market. Cost? NIX.

. . . . Bill Turner WAØABI

channel combination desired. The combinations in Fig. 3 are T1R1, T2R1, T1R2, T2R3, T3R2, T3R3, T4R4, and T4R3.

Figure 4 shows the circuit for scanning eight receive channels. The light bulbs are replaced by connections to the oscillator cathodes. The NPN transistors are used for grounding cathodes in tube type radios. In solid state radios in which a voltage is supplied instead of a ground to select the channel, a different transistor circuit will be required.

Scan Inhibitor

The clock and counter always run when no signal is being received. Manual selection is accomplished by inhibiting the outputs of the counter with the SN7401 Nand gate. The SN7401 was selected because it has open collector outputs. These can be grounded during manual selection with no ill effects to the IC. For manual selection, a ground is applied to one input of each gate. This forces all the outputs high. They can then be grounded manually by the selector switches.

BCD Counter

The SN7493 BCD counter counts from zero to seven in binary coded decimal

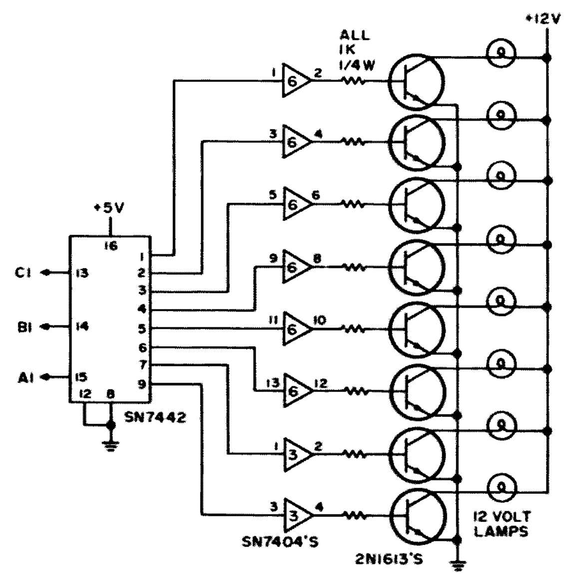


Fig. 4. Channel indication by light bulbs is possible if digital readout is not used. This circuit can also be used for scanning eight receive channels by modifying it as explained in the text.

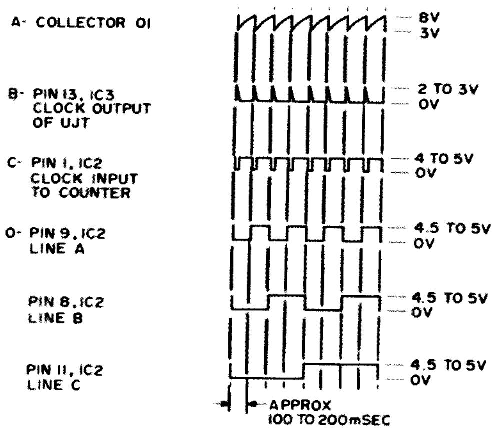


Fig. 5. The waveforms generated by Q1 as they are modified by the counting circuitry.

format (see Fig. 2). It advances one count waveforms are shown in Fig. 5.

Clock

The clock is a standard unijunction transistor circuit. Clock rate is set by the .47 μF capacitor and the 500K pot. Varying the pot changes the scanning rate. The inverter between the clock and the counter is used to square the clock pulse which is a very narrow spike coming out of the UJT.

COR

The COR circuit was borrowed from a July 1970 article in *73* on a two channel scanner by Gary Hendrickson, W3DTN. The operational amplifier in the differential input configuration is not affected by changes of B+ voltage. This is very useful in mobile installations. When no signal is being received, the squelch controlled audio amplifier plate is at the B+ potential. When a signal is received the voltage drops and forces the output of the op amp to 12 volts. This turns on transistor Q1 which stops the clock. As no clock pulses are seen by the counter, the receiver stays on the channel with the signal present. On the absense of signal, the op amp output goes to zero volts, Q1 turns off, clock pulses are generated, and the receiver scans.

Power Supply

The unit requires +12 volts and +5 volts dc. For mobile installations 12 volts is available directly from the car's electrical system, and 5 volts can be obtained with a zener diode regulator. A similar circuit can be used for ac operation. The +5 volt source should be regulated by a zener diode because the IC's operate best on +5 volts ± 25 volts.

Construction

The circuit can be built on any type of circuit board or vector board. Sockets are recommended for the IC's to facilitate removal if necessary. Parts layout is not

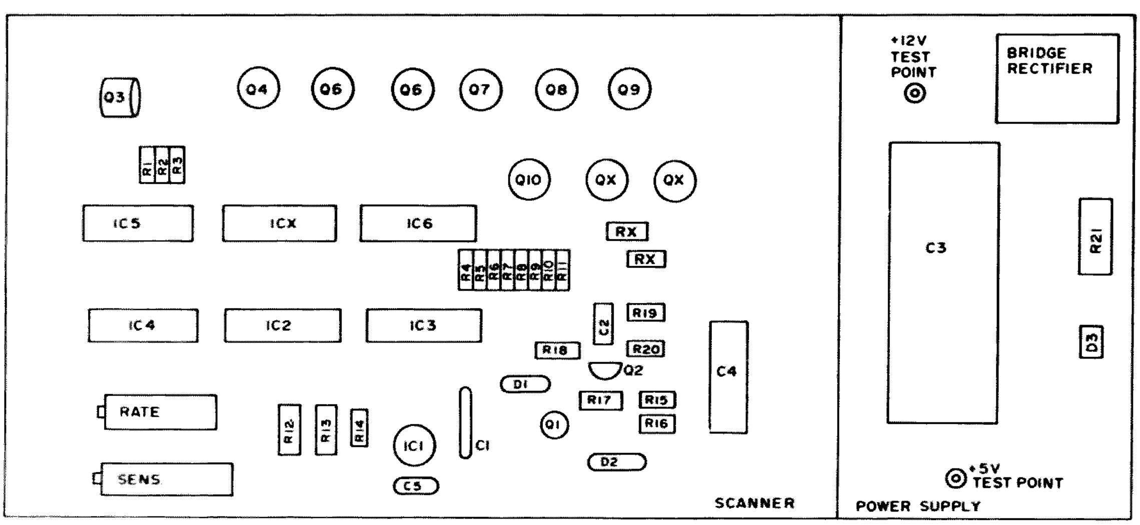
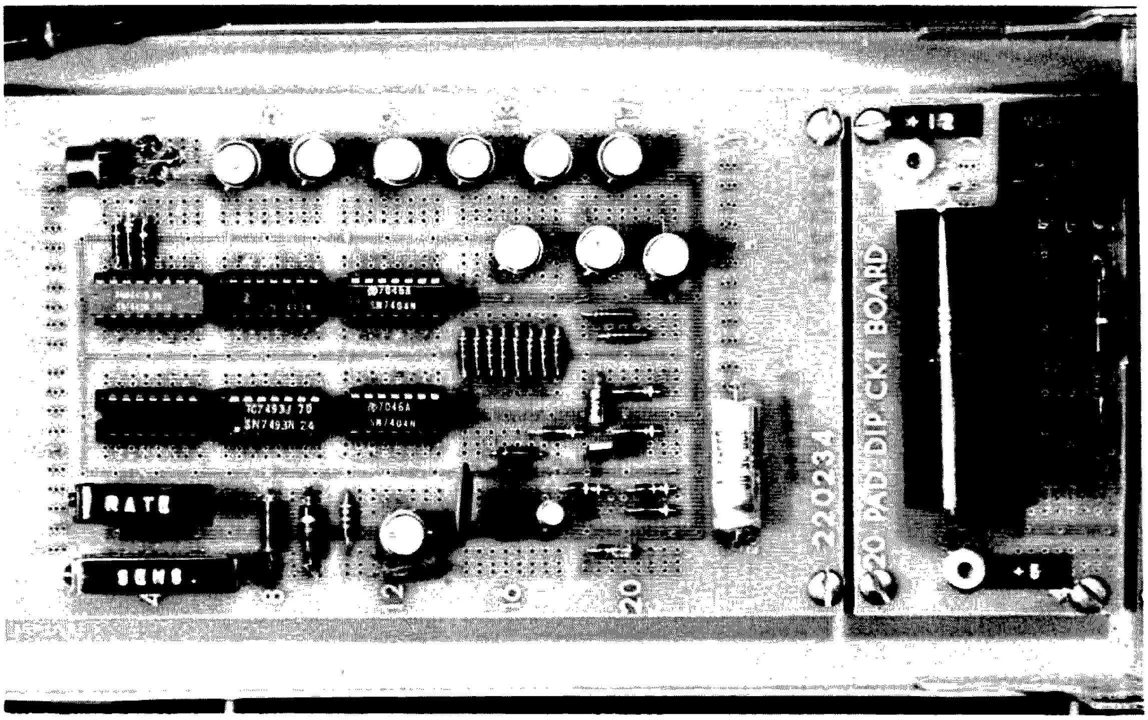


Fig. 6. Parts layout. Parts ICX, QX and RX which are not shown in Fig. 3 were added for additional switching. These parts are not required for the standard scanner. Some parts on the schematic are not on this board due to the use of a non-standard IC1. Q3 was mounted sideways in a field replacement of a defective transistor. Interconnecting wiring is on the bottom of the pc board.



Here is the completed scanning adaptor as it appears mounted next to its dual voltage power supply. See Fig. 6 for component identification.

critical. Bypassing and filtering of the 5 volt supply should not be omitted as the TTL logic is sometimes sensitive to noise.

Testing

After inspection of all wiring, apply +12 and +5 volts. Manually select each channel and observe with a voltmeter or oscilloscope that only the transistor corresponding to the selected channel is on and the others are off. For proper operation of the scanner it will be necessary to adjust the Sensitivity control on the COR. With no signal being received and the receiver squelched, measure the voltage between pins 2 and 3 of the op amp. Adjust the sensitivity control for zero volts. When the squelch opens, the voltage at pin 2 goes negative, and the output pin 6 goes to +12 volts. Q1 should then turn on.

When Q1 is off, clock pulses can be observed at pin 12 of IC3 with an oscilloscope. The pulses will stop when Q1 is turned on by a received signal.

Troubleshooting

If no oscilloscope is available, and the scanner fails to scan properly, measure the voltage at the collector of Q1 with a voltmeter. If the charging and discharging of the capacitor is seen as in Fig. 5a, and the outputs in Fig. 5d are not seen on pins 8, 9, and 11 of IC2, either Q2, IC2, or IC3 are defective. The counter can be clocked manually by alternately applying +5 volts through 5 KΩ and then ground to pin 1. If IC2 is good the counter should advance on each clock pulse. Remove the connection between IC3 pin 12 and IC2 pin 1 for manual clocking of the counter.

Conclusion

This circuit is very useful for either pairing four transmit and four receive frequencies with scanning or scanning eight receive frequencies. Only four wires are needed for remote manual control of the scanner/selector. Many variations are possible in the construction and application of the units. By utilizing integrated circuits, a minimum number of components is required. Since the price of TTL integrated circuits has become quite reasonable, the entire scanner can be built for a very small investment. By scanning four or more frequencies, one can be in on all the action.

. . .WA4WTX

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THE RCA CMU15 FM TRANSCEIVER

The RCA CMU15 450 transceiver is one of the most common rigs available recently from the commercial surplus market, and is probably the best buy. They are commonly available for less than $20 complete, and their reliability and stability are superior to other rigs of similar age. However, retired equipment is generally not found in good condition, and will require service as well as alignment. To the amateur with limited experience and test equipment, getting one of these monsters to work on amateur frequencies can be a very frustrating experience.

This article will describe specific problems and their solutions, to be used as a supplement to the RCA instruction book. Several modifications and additions will be described that can improve the performance of these units.

Take Your Pick

A group of hams will fight over a stack of radios to pick out the "cleanest" one. I have not found any indication that a clean radio works better than a "dirty" one. My base station transmitter is rusted and bent, and looks as if it has been sitting in water for some time. It has not required any repair or cleaning except for replacing tubes. Perhaps the filthy radio from a service truck has had less on-the-air use because the driver spends most of his time working, while a clean radio from a supervisor's car is being talked on all the time. I have never found rust or corrosion to be the cause of a problem.

The major problem to look for is damage to the coil shields or adjusting screws. If a screw is bent, bending it back will usually break it. If a coil shield can breaks off it is possible to solder it back *very carefully*. The can material is soft, and a torch will melt a hole right through it! If the screw is broken off, the slug can be removed with a screwdriver through the hole in the bottom of the coil.

The power and control cables should be checked and taped up if the insulation is worn. Fuse holders or circuit breakers may be damaged or lost from the cables, but the system should *always* be protected from damage in case of a short. I had a bad vibrator get stuck and blow a fifty amp fuse instantly. Lack of proper protection may also void an insurance policy.

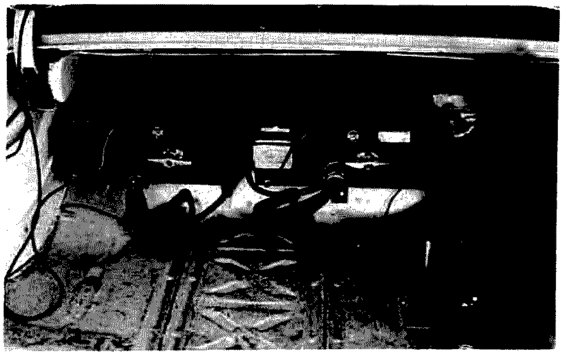
Many amateur installations are lacking in two points. The radio should be bolted securely to the vehicle body in its cabinet. This will take advantage of the large mass of the vehicle to reduce sudden acceleration (mechanical shock). The steel cabinet will protect the radio from anything you could lift to throw on top of it. Cables should be tied securely to protect them from rubbing against anything that may damage them. Control head, cables, and microphone should be mounted so they are kept away from the driver's feet to prevent damage or interfere with operation of the vehicle.

Tuning Up

The first step in alignment should be to check the tubes with a tube tester and replace the weak ones. In many cases this will be the only repair necessary. Further tube checks by substitution can be made after the radio is operating.

Receiver alignment is well described in the RCA instruction manual, but without a strong signal source aligning the front end is difficult. Lacking anything better, an old Heathkit GD-1 grid dip meter can be used. The grid dip meter with its strong signal should be tuned to one half of the desired 450 frequency *very carefully*, and placed as near as possible to the desired stage. Once the approximate tuning point is found in each of the several front end coils, tuning can continue with a weak signal. Any alignment of the i-f frequency coils should be only slight peaking since the i-f does not change with receiver input frequency.

To aid in finding a starting point, I have made some measurements of the length of exposed adjusting screw on the tops of the coils. From the antenna connector back toward the mixer, the first three brown coils, (1L1, 1L4 and 1L5), should have about 1.7, 2, and 1.7 cm of thread exposed, respectively. The next two brown coils, 1L18 and 1L19, should both be extended about 2 cm. 1Z4, the coil with the green top next to 1L18 should be 2.3 cm. The screw on 1Z15, the green coil nearest to 1Z4, will extend about 1.5 cm. The screw on the green coil next to the chassis edge, 1Z14, will only extend 0.7 cm. The last green coil next



Here's an example of a sturdy trunk mounting arrangement that avoids the usual rat's nest of wires.

to the F2 oscillator tube (or hole in the chassis) will show about 1 cm of threads. The brass slugs will be coming up out of the coil while the iron slugs will go farther into the coil for lower frequencies. These measurements may vary as much as 0.5 cm between different radios, but will serve as a handy starting point for the most difficult part of alignment.

Some of the transmitter coils can be set approximately on frequency with a grid dip meter tuned to the appropriate crystal multiple. The second doubler plate and the second tripler grid coils may have to be bent to get them down to the 148 MHz frequency if the transmitter is to operate around 444 to 445 MHz. They will tune up without trouble, but if the capacitors peak at maximum capacitance, they may not have exactly reached resonance. Always be sure that no controls peak exactly at minimum or maximum where exact resonance is necessary. The 148 MHz circuits should show a smooth definite peak, and the first doubler plate and second doubler grid coils should also peak relatively sharply. These controls should be repeatedly readjusted since they do interact. Getting drive to the final 5894 is always the hardest part of alignment. The second tripler plate adjustment should peak near the top of its range, and the PA grid screw should be down in its hole near the bottom of its travel. These adjustments tune relatively broadly. In a case where drive to the final cannot be obtained this is usually indication that either or both 5894's are flat. The PA plate adjustment is *very critical*, and turning it will probably give the first indication of transmitter output. The other antenna tuning and loading controls show definite peaks, but the PA loading adjustment will be relatively broad. Readjust all of these several times to get maximum output since they interact. These adjustments alone may be the objective of a typical two hour tweaking program.

Receiver Problems

As with the transmitter, the major cause of reduced performance is weak tubes. Even without a signal generator sensitivity check, if all the tubes are good and all the circuits tune properly, this alone is usually assurance that the receiver is working adequately.

Loss of overall sensitivity is usually caused by a weak 12AT7 in the first or second oscillator or multiplier. The 6AM4's in the front end or the 6BH6's in the first i-f need replacing less often. If the receiver seems to be sensitive enough, but is noisy, this usually indicates a weak 6BH6 in the low i-f, or occasionally a bad 12AT7 limiter. An open squelch can be repaired by replacing a defective 12AX7. In a rare occasion the glass on the 6AK6 output tube may crack.

Complete loss of audio output can be caused by a bad audio output transformer, a shorted .01 capacitor across the primary of the transformer, or a bad discriminator coil. The large .1 capacitor from the B+ line to ground may short out and cause a fuse or #43 lamp in the power supply to blow. This capacitor, 1C69, is located directly under the audio output transformer. It may be wise to replace this capacitor as well as the one across the transformer if you like to plan ahead, before they short out.

Improved receiver performance may be obtained by increasing the local oscillator signal. The 22Ω ½ watt resistor on pin one of the oscillator 12AT7 should be shorted with a short piece of wire. The same may be done to the 33K 1 watt resistor directly under the bottom of coil 1Z15; it's the only 33K in this area. Modifications such as this in the i-f stages will cause instability and will not significantly increase performance.

Receiver performance can be improved by the addition of a small transistor power supply to power the receiver only. RCA

made a power supply for this purpose which is mounted on the front panel of the cabinet, or you could build your own from surplus parts. The vibrator wiring can be modified so that the vibrators only come on when the transmitter is keyed, thus eliminating vibrator noise from the receiver. With this modification it should be possible to break the squelch with as little as .2 microvolt.

Approximately every six months it will usually be noticed that receiver performance has decreased. In this case receiver alignment and tube replacement should be made.

Transmitter Tricks

Aside from replacing tubes, the greatest improvement in transmitter output power will result from removing the selenium rectifier stacks in the power supply and replacing them with 1000 volt 1 amp silicon rectifiers. With this modification the transmitter will put out as much as 18 watts. Removal of the old rectifiers also adds considerable space for a transistor power supply, single tone oscillator, PL oscillator, or rf preamplifier for the receiver.

Removing the output "trombone" filter from the transmitter will increase power output slightly. All the old RG58 can be replaced with Belden 8219, foam RG58, which should also be used for the antenna cable. A commercial antenna manufacturer offers a mobile gain antenna with higher than usual gain specs, achieved by simply using low loss coax instead of the usual RG58. Incidentally, a gain antenna will double the effective transmitter power as well as improving receiver performance by lowering the angle of radiation, and is worth the price.

Vehicle battery voltage always has a major effect on transmitter power, and low power output may be caused by a loose or dirty cable connection since very high battery current is drawn in the transmit mode.

Low power output can be caused by a "weak" vibrator, and replacement of the vibrators often will show an improvement. If a vibrator is inserted in the socket in the 6 volt position while connected to 12 volts, the power output will increase, but it may not last for very long!

In a homebrew base station the transmitter can provide as much as 30 to 40 watts output by simply increasing B+ voltages. Remember that the current required is around 300 mA, so relays used to break the B+ current should have large enough contacts and wide enough spacing to break the surprising arc that results when B+ is removed. A monster TV power transformer will make a good base station power supply for up to 30 watts output with about 350 volts. 400 volts makes a good repeater or remote base power supply, which is about the maximum voltage. Of course, in this situation for continuous operation, forced air cooling will be required. Two 75 CFM blowers bolted to the top of the final amp and tripler cage will cool the 5894's and the 5763's so they are cool enough to touch even after several hours of key down operation.

Service problems in the transmitter other than flat tubes are rare. The 5894's are quite reliable (which is fortunate considering their price) and do not go bad suddenly. A 5763 may go flat without warning, however, causing loss of output power. The antenna relay operates off the second tripler cathode current, and may not pull in if there is no drive to that stage or the tube is flat. It is not unusual to find a fifteen-year-old 5894 still putting out 10 or 12 watts, but new tubes are the key to maximum performance.

The bias supply in a homebrew power supply can be the source of trouble if it is not properly regulated. The combined grid current of the transmitter tubes can pull enough bias current to raise the bias voltage and cut off the final PA tube.

Conclusion

The RCA CMU15 is probably the cheapest and easiest way for the beginner to get started in FM with a quality radio. With a good set of tubes and a little help getting started, service should not be a serious problem. The CMU15's good performance and low cost usually do not justify buying a later model tube radio at three or four times the cost, so the beginner may find himself keeping his CMU15 for a long time.

. . .WB6BIH

Keith Lamonica W7DXX/1
Managing Editor

2 METER FM AT 14,000 FEET

Being a DXer at heart and also very interested in 2 meter FM, I enjoy driving up to the *73* repeater site to fire up our base station to work DX during band openings. I find I can usually work up to two or three hundred miles or more during an opening. Now, since I am basically an experimenter and always want to improve on a situation, I decided there must be a better way to work 2 meter DX. The *73* repeater site is a twenty-minute drive from home, and during the winter months I have to hook up the snow buggy trailer to my Bronco and drive to the base of the mountain. The snow buggy trip up takes another forty-five minutes. After all the work of getting up the mountain, I usually lose some of my energy to work DX and just drink a couple of beers and come back down (a little faster than I went up).

Anyway, as I said, there must be a better way to work 2 meter DX. Second only to amateur radio is my big love – flying. I own a Cherokee 140D which – on the slightest suggestion – I'll fly almost anywhere. Why not install an FM transceiver in the airplane and combine both hobbies? Not a bad idea, I thought. My 140D is extremely well equipped with avionix equipment. The craft is completely IFR capable with the Genave (General Aviation) line, including their Alpha 600 with Glide slope, Beta 500 Transponder, Sigma 1500 ADF, 3 light marker beacons, and auto pilot. The point I make – as any of you who have seen the inside of a 140D can appreciate – is that panel space is at a premium. A quick measurement showed I had only 2½ inches available in the 6½ inch wide panel. Since I did not want to modify the craft in any way, I had to find a transceiver to fit my space availability. After checking all the 2 meter units we have in the *73* offices with a tape measure, I began to feel a little discouraged. Maybe those snow buggy trips to the mountain weren't so bad.

Then it occurred to me, Genave had just announced their GTX-2 transceiver for 2 meter FM. I quickly checked the specs and found the GTX-2 was exactly what I needed. A telephone call to Genave produced the rig a few days later, along with an aircraft antenna cut to 2 meters. I flew the 140 down to New Haven Avionics, and in a couple of hours John Reiser had the unit installed and operating. With a flick of the switch I could transfer mike and speaker controls from the aircraft COMM to 2 meters.

When I got back to Peterborough I found a package from Sentry with extra crystals I had ordered. The GTX normally comes with 34/94 and 94/94. If you wish, they will supply any additional frequencies. I crystaled up the GTX-2 for 16-76, 19-79, 22-82, 28-88, 34-94, 52-52, and a couple of weird frequencies.

I decided the next Saturday night would be the best time for my little DXpedition. The 140D has a ceiling of about 14,000 feet, and after 10,000 feet supplemental oxygen is needed. A trip to the friendly ambulance company – and I had a small oxygen cannister on loan.

Saturday rolled around and the weather was CAVU (ceiling and visibility unlimited).

At 6 PM I took off from Keene airport and started a climb to 14,000 feet. On the way up I was listening to WA1KGO on 19-79. At 2,000 feet I started to hear WA1KGQ in Hartford CT (100 miles). At 3,000 feet I was hearing W2AKR in Paramus NJ (200 miles). At 5,000 feet I was hearing WA3CAG in Trevose PA (300 miles). I levelled off at 14,000 feet over Peterborough and started punching up different frequencies.

On every frequency I listened, there were at least two or three repeaters present. My first mistake was to key up 34/94. It took five minutes (or so it seemed) for all the repeaters to drop out. It soon became evident that operation on standard repeater frequencies was nearly impossible. I decided to try a couple of non-standard repeaters. I punched up W1DC which is 147.72 in and 147.12 out. Right away I heard a QSO in progress and decided to listen awhile. After a minute or so I realized it was not W1DC I was listening to, but WA4UAG in Huntsville AL (1000 miles). WA4UAG is a tremendous machine with an input on an off-channel which I just happened to have. A quick crystal change and I was talking to K4YMB through the Huntsville repeater. After a short chat, I took a couple of deep breaths from the oxygen cannister and switched to 16-76. Fortunately there wasn't too much activity, and I was able to hear WA9ORC in Chicago with a full quieting signal. When I tried to call in, however, I keyed up a multitude of stronger 16-76 repeaters. 52 simplex proved rewarding with contacts to South Carolina, West Virginia, Tennessee and Canada made with ease. After about five or ten minutes there was so much activity on 52 that it was difficult to hear anyone.

Another two hours were spent checking different frequencies. Repeaters up to 1000 miles were heard consistently, but contacts were few on the common frequencies since I was keying up so many of them.

I have definitely found a new way to enjoy 2 meters and have also learned a few things. I have ordered reverse pair crystals for the common repeater frequencies and also for the simplex frequencies. Look for me on 2 meter FM some night. It's a blast.

...W7DXX/1

SIMPLE LIGHTNING DETECTOR

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For those remote repeater sites!

The circuit shown in Fig. 1 wasn't really meant to be a lightning detector – originally it was part of a burglar alarm we built and installed some time back. But the first night we had a lightning storm all the bells and whistles went off and the neighbors . . . well, anyway, here we have a lightning detector that works quite well.

Not everyone *needs* a lightning detector, of course, but it is very handy for those stations that normally operate round the clock and unattended – repeaters, private repeaters, and remote control systems such as autopatches. In that case the lightning detector can temporarily disable the station and ground the antennas when a storm is in the vicinity.

Figure 1 shows the basic circuit. A small, sensitive SCR is in series with a relay coil. When a positive pulse appears on the SCR gate, the SCR turns on and energizes the relay. A 20 ft pickup wire attached to the gate and strung about the house works quite well to couple lightning-caused pulses into the diodes. Once the SCR latches, the circuit remains on until the power is removed.

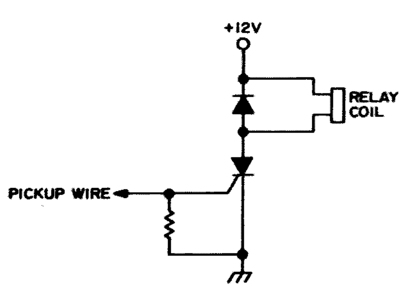

Fig. 1. Basic circuit of the lightning detector.

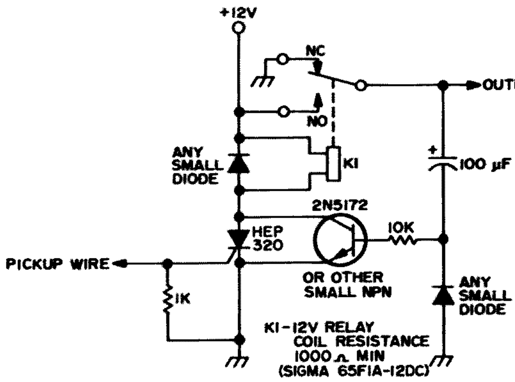

Fig. 2. Circuit with automatic reset.

Figure 2 shows an improved version which automatically resets itself after a while. The SCR works as before, but when the relay closes +12V is applied to the top of the capacitor, which then slowly discharges through the 10K resistor and the base of the transistor. The transistor is across the SCR and lets the SCR release immediately after the lightning stroke is over. The relay stays pulled in for a short time interval, depending on the gain of the transistor and the quality of the 100 μF capacitor, and then opens.

In operation, make sure the pickup wire is far enough from your transmitter and antenna that it does not pick up rf energy from there. If any rf does get into the pickup wire, use a loop of wire whose far end is grounded. We haven't had any trouble in that regard, and the detector picks up any storms that are close enough to be seen and heard. If the sensitivity is too high, simply use a shorter pickup wire.

. . .K2OAW

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CITIZENS BAND ALIGNMENT AID

The need for better tuneup aids for CB radios has been well documented by W2NSD/1. (See *73* Feb. '73, pages 5 and 6.) Well, FELLOW AMATEURS, I must admit to holding out on you, just a bit. I have been in possession of an excellent circuit for such a need for about seven years. I recently updated it with a more modern transistor and a Printed Circuit Board. A comment here, to explain that I also hold a First Class Radiotelephone License, and on occasion repair CB radios. Also remember that no license is required to tune the receiver.

It is obvious that the front end of a receiver should be tuned to respond equally well across the band, and thus have consistent sensitivity at any frequency in the band, if maximum usefulness is to be obtained. The usual method of insuring reasonable results is to tune at the middle, and check the ends. This is rather spotty, at best, as it would be better to check all channels. This is involved since you must set both frequency and amplitude 23 times in a single pass.

Naturally, a good sweep generator could be used, and the rf-mixer tracking set with it instead, but this was not available to me at the time. The circuit in Fig. 1 was originally a super-regenerative receiver taken from the GE Transistor Manual. These, as is well known, tend to spray a lot of rf back out the antenna. With this in mind, I listened with a communications receiver and noted strong modulation products about 100 kHz above and below the "carrier." Deducing this to be caused by the quench frequency, I brilliantly decided to drop the quench frequency into the audio range, by increasing the capacitance across the base bias resistor. Lo and behold! Suddenly the entire Citizens Band was alive and jumping with a mass of "line noise," which at first appeared to be like natural noise. Then I turned on the BFO, which showed it to be many, many, many closely spaced "carriers." I presume the lower quench frequency develops a much larger bias swing on the base of the transistor, FM'ing it across the entire band. This stuff is concentrated in the region of 27

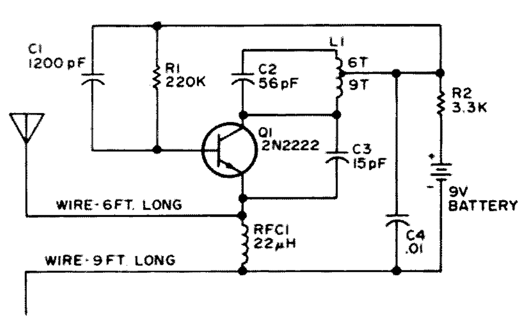


Fig. 1. Schematic of the alignment aid. L1 is 15 turns No. 22 tapped at 9 turns from the collector end. No switch is shown, so remove battery when not in use.

MHz, with very little spill-over into 10 or 15 meters, although the level across the design range is rather constant. The nearly constant rf level is what I needed to simplify tuneup of the front ends of the units I was working on.

Figure 2 is the layout of the P.C. board I made to facilitate reproduction of this useful circuit for a few interested friends and Fig. 3 is the component layout.

I used 6 ft of wire as an antenna connected to the emitter side of the rfc, with 9 ft of wire on the battery side of the rfc as a counterpoise. Since this made it a bit large, I carefully hung it vertically in a handy tree nearby. Of course, since this put a strong signal on every channel into every CB receiver within 300 yards, I limited the use of this device to avoid unnecessary interference to the deserving users of the band. However, one fellow accidentally launched his into a tree too high to recover with an over-ambitious heave, and it ran for about a month in the dead of winter in a nameless northern city, helping every CBer for miles around align their sets! It only draws about half a milliamp from a 9 volt battery.

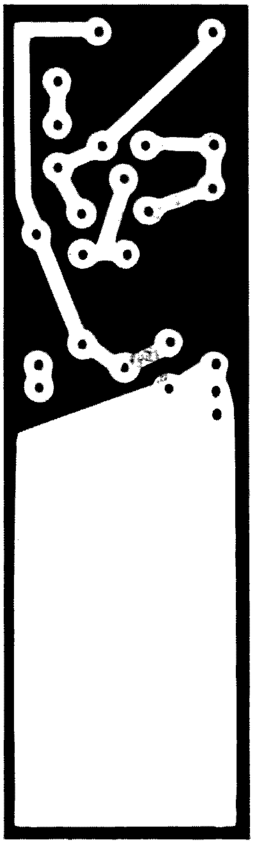


Fig. 2. Full size PC board layout (foil side).

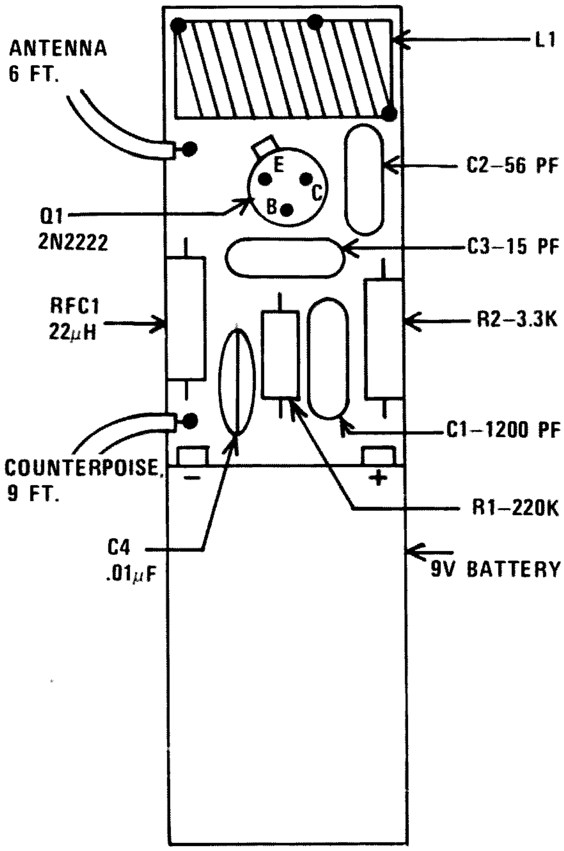
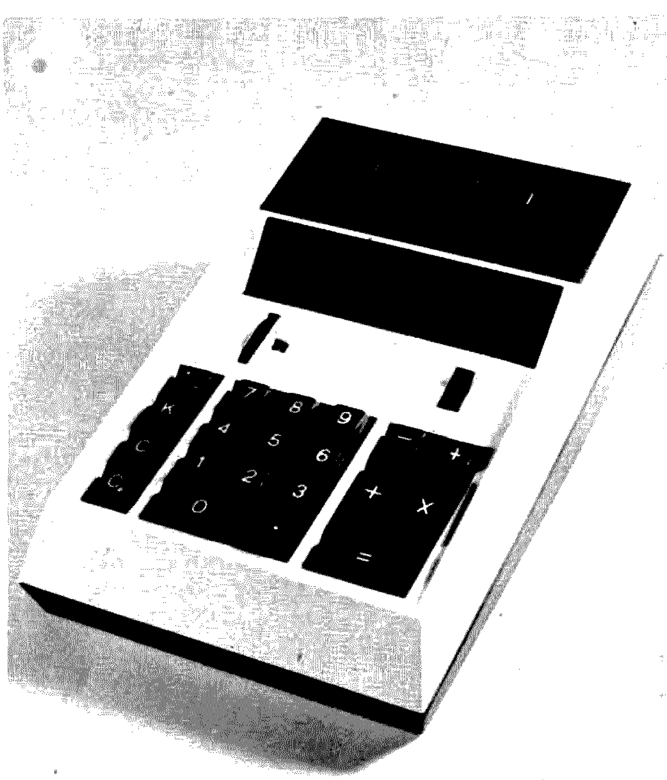


Fig. 3. Component side parts placement.

Since I am sure many others would like to align their 11 meter receivers for optimum results, I am presenting this circuit as a very low cost and worthwhile aid. If I receive enough inquiries, I could possibly have P.C. boards made up. These boards could also be used to make a compact superregenerative receiver as per the original circuit. I am sure the changes required to put this on any other HF band are well within the scope of the readers of the magazine. I would estimate the cost to be about $1.50 per P.C. board, plus shipping.

. . .WA5SWD

Ron Subka WA9FPP/1
Technical Editor



HEATH DESK-TOP CALCULATOR

A Ham-Convenience product of the Electronic Age. Once you have one you would betray your own mother in order to keep it!

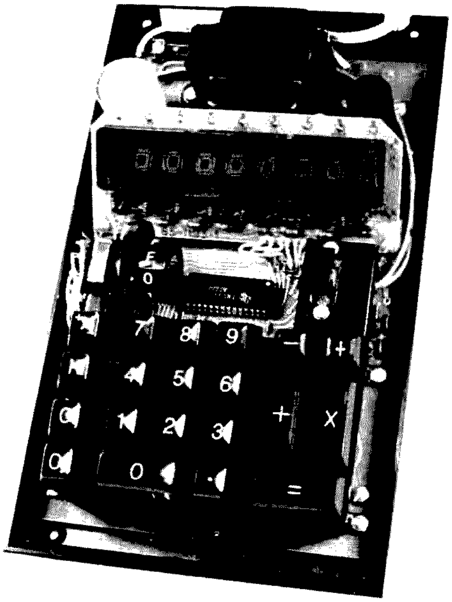
This article should not be read by anyone who enjoys the manipulation of numbers from one side of a page to another. If you have ever noticed yourself even slightly smiling while performing a simple task such as finding the LC Constant for a particular frequency – Go Away!

Now, as the *rest* of us all know, the bad guy within those too-numerous electronic equations is the Algebra. In theory, equation solving is easy. Values are simply plugged-in for the variables and the end product is happily solved. (Ho!) In *practice* however, the easy part of equation solving is over more-and-more as the Algebraic calculations go on-and-on. Somewhere near the bottom of the second page, (where you neatly dropped a set of brackets) trouble usually begins. It is not immediately noticeable because of your search for that decimal point that was there just a minute ago . . . you are not even aware that you are moments away from rediscovering Avagadro's number.

The Heath IC-2008 electronic calculator kit can restore faith in anyone's mathematical prowess. It adds, subtracts, multiplies and divides faster than any living EE graduate, and is undoubtedly more accurate. It will read to 8 digits (with polarity and overrange indication) and features a floating or selectable fixed decimal point. Besides the numerals, addition and subtraction buttons, etc., it has buttons for polarity change, constant (K) storage, display Clear (to erase the last entry only) and machine Clear (to completely clear the calculator). The seven segment display tubes are neon filled and are large and bright enough to be read from across the room. The unit operates from 115V ac and sells for $129.95.

Assembly

The first thing I looked for in the pile of components was the heart of the unit, a Large Scale Integration (LSI) 40 pin IC. I took it out of its plastic box and examined it closely . . . quite an IC! Later, as I neared



A few hours of assembly and those bags of parts start to look like . . .a calculator.

completion of the calculator, I noticed a CAUTION notice warning the builder not to touch the pins on the IC as a measure against static damage. The notice was on page 32 of the assembly manual! Fortunately the IC received no damage but handling could have been avoided with a small caution sticker on the box that contained the IC.

The circuitry is assembled on two separate boards. The main board holds the power supply and calculator components. The smaller board holds the Sperry Rand SP-733 readouts and their associated driver transistors. Heath's instructions were excellent and no problem was encountered while assembling the boards. In most cases, eight or ten parts were mounted before a quick pass was made down the board with a soldering iron.

Care must be taken when mounting the big IC in its socket because 40 pins tend to go in 40 different directions all at once. A preliminary adjustment of the socket pins on the circuit board will help to avoid this problem.

The rear half of the unit contains the actual electronics while all available space to the front of the display tubes is filled with the push button switches. The buttons press-fit onto the switch stems.

The calculator was turned on after it was completed and the No. 8 button was pushed a few times to check the operation of the display. One of the segments did not want to light and the problem was traced to its driver transistor. A slight tap on the transistor caused the segment to light, so a touch of solder was added to all three leads as a remedy for the mysterious bad joint. There were no further problems and the unit was tested.

The three pages of testing instructions are laid out well and are easy to follow. Tests take about fifteen minutes.

Operation is extremely simple. Just tap out the numbers you are working with while specifying to the machine the function it should perform. Complete operating instructions are included to help you become familiar with the various functions. The constant feature is really a bonus. This lets you store a preselected number in the calculator that will either multiply or divide into any number or series of numbers as fast as you can push the buttons. By entering 18 as a dividing constant you can get the 8 MHz crystal frequencies for the 2m FM channels by pushing the buttons for each 2m frequency followed by a quick push on the TOTAL bar. Receive crystals are just as easy. If you have a 10.7 MHz i-f, subtract 10.7 from the 2m frequency and divide by 3. A complete correlation chart can be made for any rig in just a few minutes. And of course that stock of weird crystals you have around the shack can be multiplied-up by entering each frequency as a constant and working up the keyboard to see if anything interesting shows on the display.

Add One

The Heath Calculator, besides being mathematical, can solve other problems (grief) as well. The time and energy saved while using this little machine is phenomenal. If a mistake is made part way through the problem you are working on, just erase everything and start over. You'll have the new solution in less time than it would take to find the mistake if you were working on paper. Even if you never particularly enjoyed working with formulas, this calculator will have you designing your own coils, filters and solid state rf amplifiers within a week.

. . .WA9FPP/1

Herbert S. Brier W9EGQ
385 Johnson Street
Gary IN 46402

TRANSISTOR RF POWER AMPLIFIERS PART II

Figures 2 and 3 depict the two forms of the L network – input resistance less than output resistance and input resistance greater output resistance, respectively. And Fig. 4 depicts the pi network. None of the equations governing these networks are overly complicated. Nevertheless, using them to design the input and output tank circuits of a practical rf amplifier does require quite a few calculations of little interest to readers not mathmatically inclined. For convenience, therefore, we have put the equations and the calculations made in designing the 10 watt (nominal) rf power amplifier described below into the appendix of this article.

The illustrative calculations are made for a frequency of 145 MHz, but complete component data for all amateur bands between 3.5 and 148 MHz are included in Tables I, II and III.

Designing a 145 MHz Transistor Power Amplifier

Let us design a 10 watt (nominal), 145 MHz booster amplifier to be driven by the output of a one or two watt FM transceiver. As developed earlier, for best results rf power transistors must be operated reasonably close to their design frequencies. We select the modern, balanced-emitter 2N5590. Its essential characteristics are:

Type	2N5590
VCC	13.6V dc
Dissipation	30 watts
Output Capacitance	80 pF[1]
Typical operation at 145 MHz	
Power Output	14 watts[2]
Driving Power	2 watts
Power Gain	8–9 dB
Input Resistance	2.5Ω

[1] Varies somewhat with frequency
[2] With two watts drive

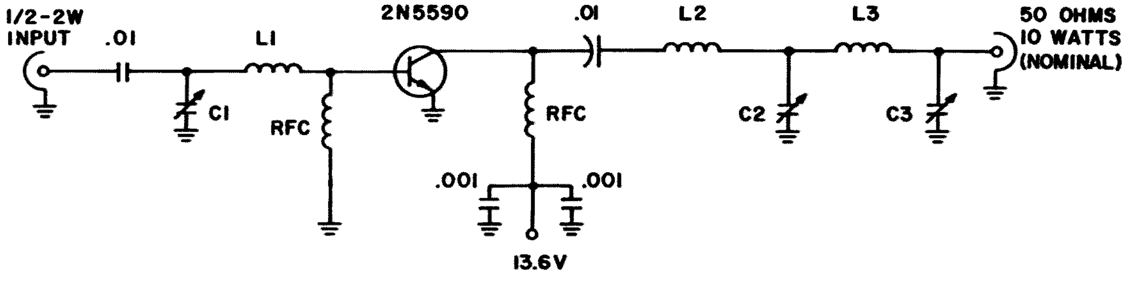


Fig. 1. Typical transistor rf power amplifier.

Solving equation 1 for a dc collector voltage of 13.6 and a power output of 14 watts gives a transistor output resistance of 4.7Ω. L network A would seem a logical choice to match this resistance to a 50Ω load. But, we note that the transistor output resistance is in parallel with the 80 pF output capacitance of the transistor.

If network A had an input capacitor to ground, the simple way of compensating for the transistor parallel output capacitance would be to decrease the value of the input capacitor enough to compensate for the transistor capacitance. As L network A does not have an input capacitor, however, we use equations 12, 14, and 15 to transform 4.7Ω in parallel with 80 pF to their equivalent values of 2.8Ω in series with a capacitive reactance of 0.94Ω (at 145 MHz).

Now solving equations 2 and 3 for input and output resistances of 2.8 and 50Ω, respectively, gives values of .012 μH and 90 pF for the L network. Adding .001 μH to the calculated inductance to compensate for the 0.94Ω series output capacitance of the transistor brings the total inductance up to

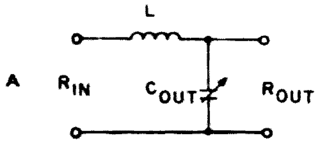


Fig. 2. L Network when input resistance is less than the output resistance.

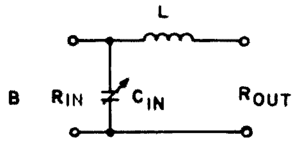


Fig. 3. L network when input resistance is greater than the output resistance.

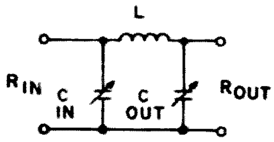


Fig. 4. Pi network.

TABLE I
VARIABLE CAPACITOR AND INDUCTOR DATA
POWER OUTPUT 10–15 WATTS, NOMINAL

VCC: 13.6 volts

Band MHz	C1 pF	C2 pF	C3 pF	C4 pF	C5 pF	C6 pF	L1 μH	L2 μH	L3 μH	RFC1 μH	RFC2 μH
145	Omit	150	50	50	100	50	.055	.062	.067	0.5	0.6
50	Omit	450	100	Omit	300	150	.1	.06	.2	1.0	2.0
28	Omit	750	Omit	Omit	500	250	.06	.125	.34	2.0	3.0
21	Omit	1000	Omit	Omit	750	375	.09	.18	.5	3.0	4.5
14	100	300	Omit	Omit	1000	500	.39	.27	.67	4.5	6.0
7	200	600	Omit	Omit	1300	1000	.78	.71	1.82	8.0	10.0
3.5	400	1200	Omit	Omit	2600	2000	1.56	1.42	3.74	12.0	14.0

VCC: 28 volts

Band MHz	C1 pF	C2 pF	C3 pF	C4 pF	C5 pF	C6 pF	L1 μH	L2 μH	L3 μH	RFC1 μH	RFC2 μH
144	Omit	150	50	50	100	100	.055	.1	.067	0.5	1.0
50	Omit	450	100	Omit	200	300	.1	.29	.19	1.0	3.0
28	Omit	750	Omit	Omit	125	150	.06	.64	.46	2.0	6.5
21	Omit	1000	Omit	Omit	150	200	.09	.82	.64	3.0	9.0
14	100	300	Omit	Omit	250	300	.39	1.3	.94	4.5	13.0
7	200	600	Omit	Omit	450	600	.75	2.6	1.85	8.0	26.0
3.5	400	1200	Omit	Omit	900	1000	1.56	5.0	3.6	12.0	50.0

.013 μH. But calculating the Q of the network with the aid of equation 4 reveals a Q of only 4, certainly insufficient to prevent transistor distortion products from reaching the load.

An L-pi network between the transistor and the load will increase the circuit Q to a more satisfactory level. By stepping up the 2.8Ω input resistance to 150Ω in the L net for a resulting Q of 7.5 and designing the pi network for a Q of 3 to step the 150Ω back down to 50Ω at the network output terminals makes the overall circuit Q equal to 22. A Q of 22 is a reasonable figure for a transistor output tank circuit.

Referring to Fig. 1, the calculated L-pi network component values of 145 MHz are: L2, .021 μH; L3, .067 μH; C2, 100 pF variable; and C3, 50 pF variable. (The output capacitance of the L network and the input capacitance of the pi network are combined in capacitor C2.)

L network B is selected to match the 50Ω driver resistance to the 2.5Ω transistor base resistances. Its calculated component values are: L1, .011 μH; and C1, 100 pF.

Unfortunately, attempting to construct a 145 MHz amplifier using the circuit diagram of Fig. 1 and the calculated values for coils L1 and L2 would probably result in failure. The inductances are so low that stray circuit inductances would reduce the physical size of the coils to the vanishing point. But refer to Fig. 5 and capacitors C1, C3 and C4.

TABLE II
TRANSISTORS USABLE AS RADIO FREQUENCY POWER AMPLIFIERS IN AMATEUR TRANSMITTERS

Type	Band[1] MHz	VCC CW volts	IC Amps max.	Pwr Dis. watts	Pwr Out watts	Notes
2N1725	3.5	30	5	117		ft 10 MHz
2N2947	50	25	1	25	15	
2N2948	28	25	1	25	15	
2N2949	28	25	.32	6	3.5	2.5 watts out at 50 MHz
2N3295	2–100	15		2	.3 PEP	14–17 dB power gain
2N3296	28–50	30		6	3 PEP	16–19 dB power gain
2N3297	21–88	30	1.5	25	12	10–13 dB power gain
2N3375	144–220	28	1.5	11	6.5	7 dB power gain
2N3553	144	28	1	7	3.5	10–12 dB power gain
2N3632	144	28	1	23	14	7 dB power gain
2N3738	3.5	120	.14	20	10	ft 10 MHz
2N3818	50	28	1	25	15	Power out 15 watts at 15V
2N3927	144	13.6	3	23	12	6 dB power gain
2N3950	50	28	3	70	50	22 watts out at 13.6V
40082	1.8	13.8			35	Amplitude modulated
40444	1.8	13			20	Amplitude modulated
40340	50	13.5			25	
2N5161	144	28	1.5	20	8	PNP
2N5162	144	28	5	50	30	PNP
2N5346	7	30	7	60		ft 30 MHz
2N5589	144	13.6	1	15	4	10 dB power gain
2N5590	144	13.6	3	30	14	10 dB power gain

[1] *Transistors may work on adjacent bands also.*

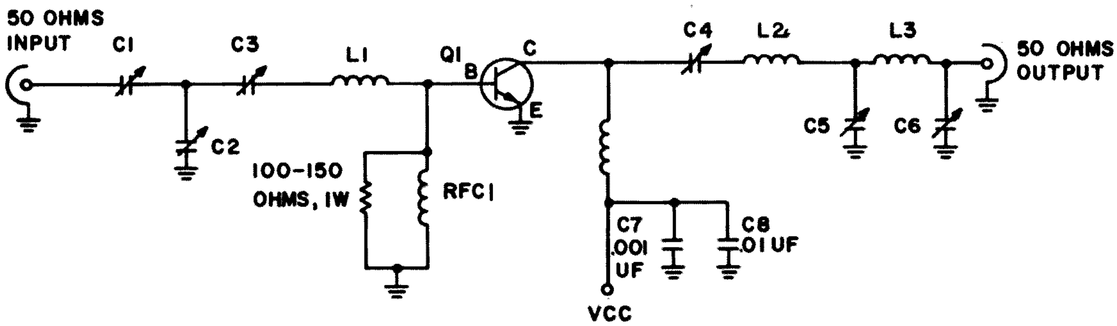


Fig. 5. Transistor "booster" rf power amplifier circuit. Component values for different frequencies and voltages are discussed in the text and tabulated in Tables I, II and III.

Assume for the moment that capacitor C1 is shorted out and that capacitor C3 in series with coil L1 has a capacitance of 25 pF, equivalent to a capacitive reactance of 44Ω at 145 MHz. Ignoring stray circuit inductances, the inductance of the coil will have to be increased from .011 μH to .055 μH to overcome the effects of the capacitor. Thus, adding capacitor C3 to the circuit permits making coil L1 a practical size. Capacitor C4 performs a similar function in conjunction with coil L2 in the output network.

Within limits, the series capacitors permit cancelling out any desired percentage of the coil and circuit inductance. To be effective, they must have low minimum capacitances and very low self inductance. Such series capacitors are seldom required on frequencies below 50 MHz. On the other hand, the calculated capacitance values in low-impedance L networks become rather large at frequencies below 14 MHz.

At 7.2 MHz, for example, the input capacitor of an L network designed to match 50Ω to a 2.5Ω load would have a capacitance of over 2000 pF. But if the 50Ω can be made to appear as a higher resistance to the L network, the input capacitance (C2) can be decreased.

TABLE III
DIMENSIONS OF SELECTED SMALL COILS

Estimated Inductance	Number of Turns	Coil dia.	Turns/inch or length	Wire size
5 μH	30	1/2"	32 t.p.i.	26
3.6 μH	24	1/2"	32 t.p.i.	26
2.6 μH	16	1/2"	32 t.p.i.	26
1.85 μH	13	1/2"	32 t.p.i.	26
1.3 μH	16	1/2"	16 t.p.i.	22
0.94 μH	13	1/2"	16 t.p.i.	22
0.82 μH	11	1/2"	16 t.p.i.	22
0.64 μH	9	1/2"	16 t.p.i.	22
0.46 μH	6	1/2"	16 t.p.i.	22
0.2 μH	4	1/2"	1/2" long	16
0.13 μH	5	1/4"	1/2" long	16
0.07 μH	4	1/4"	4 t.p.i.	16
0.05 μH	2	1/4"	3/8" long	16

Exact inductance of smaller coils is controlled largely by spacing between turns and lead lengths. Slug-tuned and torodial coils may also be used in transistor rf power amplifiers.

As shown by the calculations in the Appendix, connecting a 150 pF capacitor (CI of Fig. 5) in series with the amplifier input lead reduces the required capacitance of C2 from over 2000 pF to 485 pF at 7.2 MHz. At the same time, the inductance of LI is increased from approximately 0.2 μH to .78 μH.

It is also possible to control the relative values of capacitance and inductance in L-pi networks by varying the value of the intermediate resistance chosen to calculate the L-pi component values.

These expedients were used in compiling Tables I and II. The tables list component values for nominal 10 watt output transistor rf amplifiers for the various amateur bands. Table III, in turn, lists winding data for suitable inductors for the amplifiers. Use the tables in conjunction with the diagram of Fig. 5.

Besides the obvious precaution to use good rf construction practices, such as keeping leads short and isolating input and output circuits from each other, probably preventing low frequency parasitic oscillations is a major requirement in building successful transistor rf power amplifiers.

Selecting rf chokes with the minimum usable reactance at the operating frequency helps control low frequency parasitic oscillations by bypassing them to ground before they start. Suitable rf choke values are listed in Table I. Also helpful in taming transistor rf power amplifiers to hold down the Q of the base rf choke to around five. One way of controlling its Q is to wind the choke around the body of a 100Ω, 1 watt, non-inductive resistor. Terminate the choke leads at the resistor leads where the latter come out of the resistor. Bypass the "cold" side of the rf chokes with two different size capacitors in parallel. One should have a capacitance of approximately .001 μF, and the other one should have a capacitance in the vicinity of 0 1 to 0.2 μF. Finally, keep the base-to-emitter resistance and voltage as low as possible. This last precaution is most important when either the base or emitter are not directly grounded for dc.

Although the 2N5590 and a few other modern rf power transistors can survive mistuning and operating into highly mismatched loads at rated voltages, most transistors are not so rugged. Consequently, first adjustments should be made at reduced voltages and drive. Once the amplifier is found to be stable and is delivering power to a load, dc collector voltage and rf drive to the base can be increased without exceeding rated currents. Watch for signs of instability and overheating in the process; an amplifier that may be stable at low voltages may become unstable at higher voltages. But a properly built and operated transistor rf power amplifier is a reliable piece of electronic equipment.

Note: Different values of intermediate resistance were assumed in calculating the component values of the L-pi output networks on different frequencies; so that capacitors C5 and C6 are of reasonable capacitance. Their required capacitance can be built up by fixed mica capacitors in parallel with a variable capacitor for fine adjustment.

APPENDIX
EQUATIONS

Output resistance of an rf power amplifier:

$$Ro = (Vcc - Vmin)2/2Po \qquad (1)$$

Where Ro = output resistance in ohms. Vcc = dc collector voltage. Vmin = minimum instantaneous collector voltage. And Po = power output in watts. (Vmin is approximately 2 volts for most rf power transistors. It is often ignored in routine calculations.)

L network equations:

A – Input resistance less than output resistance

$$Xc = Rout\sqrt{Rin/(Rout - Rin)} \qquad (2)$$

$$Xl = Rout \times Rin/Xc \qquad (3)$$

$$Q = Rout/Xc \qquad (4)$$

B – Input resistance greater than output resistance

$$Xl = \sqrt{(Rout \times Rin) - R^2} \qquad (5)$$

$$Xc = (Rout \times Rin)/Xl \qquad (6)$$

$$Q = Rin/Xc \qquad (7)$$

Pi network equations:

$$Xcin = Rin/Q \qquad (8)$$

$$Xcout = Rout\sqrt{(Rin/Rout)/Q^2 + 1 - (Rin/Rout)} \qquad (9)$$

$$Xl = \frac{(Q \times Rin) + (Rin \times Rout/Xc2)}{(Q^2 + 1)} \qquad (10)$$

Where Xcin, Xcout = capacitive reactance in ohms, Xl = inductive reactance in ohms.

Rin, Rout = resistance in ohms. Q = circuit "figure of merit." (Is automatically set by circuit values in L networks. May be predetermined in pi networks as long as Xl exceeds $\sqrt{\text{Rin x Rout}}$). (11)

Most electronic handbooks contain charts for converting capacitive and inductive values into equivalent reactances at the desired frequency. The values may also be computed using the following equations:

$$Xc = 1{,}000{,}000/2\pi FL \quad (12)$$
$$Xl = 2\pi FL \quad (13)$$

Where F = frequency in MHz, L = inductance in microhenries (μH). C = capacitance in picofarads (pF). π = 3.14. Xc = capacitive reactance in ohms; Xl = inductive reactance in ohms.

Converting a resistance in parallel with a reactance to equivalent series values or vice versa:

$$Rs = Rp/\ [1 + (Rp/Xp)2] \quad (14)$$
$$Xs = X\,(Rp/Xp) \quad (15)$$
$$Rp = Rs \times (1 + [Xs/Rs]^2) \quad (16)$$
$$Xp = Rp/(Xs/Rs) \quad (17)$$

Where Rs = series resistance. Rp = parallel resistance. Xs = series reactance. Xp = parallel reactance. All values in ohms.

CALCULATIONS

Transistor output resistance from equation 1: Ro = (Vcc – Vmin)^2/2Po. Vcc = 13.6 volts, dc, Vmin = 2 volts, Po = 14 watts. Ro = (13.6 – 2)^2/(2 x 14) = 4.7Ω.

Converting 4.7Ω in parallel with 80 pF into equivalent series form at 145 MHz: From equation 12, Xc = 1,000,000/2πFC, where π = 3.14, F = frequency in MHz and C = capacitance in pF: Xc = 1,000,000/2 x 3.14 x 145 x 80 = 14Ω (capacitive). From equation 14, Rs = Rp[1 + (Rp/Xp)^2], where Rp = 4.7Ω, and Zp (calculated above) = 14Ω: Rs = 4.7[1 + (4.7/15^2 = 2.8Ω. From equation 15, Xs = Rs x (Rp/Xp): Xs = 2.8 x (4.7/14) = 0.94Ω (capacitive).

Solving equation 2, 3 and 4 for an input resistance of 2.8Ω and an output resistance of 50Ω: Xc = Rout$\sqrt{\text{Rin (Rout – Rin)}}$ = 50 $\sqrt{2.8/50 - 2.8)}$ = 11.5Ω (capacitive) which is equivalent to 90 pF at 145 MHz. Xl = Rout x Rin/Xc = 50 x 2.8/11.5 = 13Ω (inductive). Q = Rout/Xc = 50/13 = 4.

Add 0.94Ω inductive reactance to the calculated Xl to compensate for the 0.94Ω

Xc in series with it: 13 + 0.94 = 13.96Ω, equivalent to 0.14 μH at 145 MHz.

Calculating component values for L-pi network for matching 2.8Ω to a 50Ω load. Intermediate resistance, 150Ω. L network calculations: Xc = Rout Rin/(R – Rin) = 150 2.8/(150 – 2.8) = 20Ω (capacitive), equivalent to 50 pF at 145 MHz.

Xl = Rout x Rin/Xc = 150 x 2.8/20 = 21Ω (inductive), equivalent to .021 μH at 145 MHz. Q = R/Xc = 150/20 = 7.5.

Pi network calculations:

Q = 3, selected so that total L-pi network Q would be between 20 and 25.

From equation 8, Xcin = Rin/Q = 150/3 = 50Ω (capacitive), equivalent to 22 pF at 145 MHz.

From equation 9, Xcout = Rout (Rin/Rout)/Q^2 + 1 – (Rin/Rout) = Xc = 50 (150/50/9 + 1 – (150/50) = 32Ω (capacitive), equivalent to 35 pF at 145 MHz.

And from equation 10, Xl = (Q x Rin) + (Rin x Rout/Xcout) = Xl = (3 x 150) + (150 x 50/32) = 68Ω (inductive), equivalent to .067 μH at 145 MHz.

Calculating input L network to match 50Ω to 2.5Ω. From equation 5, Xl = (Rout x Rin) – R^2 = Xl = (2.5 x 50) – 2.5^2 = 11Ω (inductive), equivalent to .011 μH at 145 MHz.

From equation 6, Xc = (Rout x Rin)/Xl = Cx = (2.5 x 50)/11 = 11Ω (capacitive), equivalent to 100 pF at 145 MHz.

Effects of connecting a 150 pF capacitor in series with input lead of amplifier at 7.2 MHz. From equation 12, 150pF has a capacitive reactance of 150Ω at 7.2 MHz. And from equation 16, Rp = Rs x (1 + $[Zx/Rx]^2$ = Rp = 50 x (1 + $[150/50]^2$ = 500Ω.

From equation 17, Xp = Rp/(Xs/Rs) = Rp = 500/(150/50) = 167Ω (capacitive), equivalent to 125 pF at 7.2 MHz.

Calculation of component values for L network for 500Ω in and 2.5Ω out.

From equation 5, Xl $=\sqrt{(\text{Rout x Rin}) - (\text{Rout})^2}$ = Xl $=\sqrt{(2.5 \text{ x } 500) - 2.5^2}$ = 35Ω (inductive), equivalent to .79 μH at 7.2 MHz.

From equation 6, Xc = (Rout x Rin)/Xl = Xc = (500 x 2.5)/35 35Ω (capacitive) equivalent to 635 pF at 7.2 MHz.

. . .W9EGQ

LETTERS

COVER

Upon receipt of the February issue I knew I could keep my silence no longer. WOW! That cover sure wins my seal of approval, and so does the stuff inside. Keep my 73's coming.

Jerry Johnson WA5RON
Austin TX

UNCOVERED

I see from the numbers on the cover on the February issue that your name has changed from seventy-three to seven point three! A few more covers like this should bring up your circulation. It did mine.

T.L. Powell KØWNB
Peyton CO

C.OVER

In the whole history of printing, you have published the nicest decimal point ever.

Jake WB2PAP
Walden NY

73 IS using the metric system, you know . . .

ANTI-FETISH

My Gosh, man, use some taste. Never before have I seen a more unattractive pair of feet on the cover of a ham radio magazine.

D. M. Casselman WAØGSY
Conway Springs KS

Those aren't feet . . . they're centimeters!

KINTS & HINKS?

You have a great magazine, but there are some things I would like to see. How about a small section each issue devoted to helpful gimmicks that we have found? I'm sure everyone would have a couple of unusual little hints that all would benefit from.

Buddy Wilkins WN4YIL

220

I've been sitting idly by the last few months reading letters from interested parties on the subject of who should have the 220 MHz band, amateur radio or citizens band? In my opinion the question is not who is pushing the issue or why but rather do the CBers deserve additional frequencies? My answer to this is NO. They had their chance with the 27 MHz band and look what happened to that, with all the illegal activity going on! They should not be rewarded for operating illegally, but punished. Instead of giving them more room to operate they should take some frequencies away. If any CBers object to this letter I ask that they seriously compare their band and its operating practices with that of amateur radio operating practices. They will see right off, if they are honest with themselves, that amateur radio is superior. Therefore amateur radio should be allowed to keep 220 MHz until they show that they DO NOT deserve it.

Tim Stickney WB6PRW
Ft Bliss TX

The question really IS who is pushing the issue, for this is a political (money) issue, not one of who deserves what band. Manufacturers believe that they will make a lot of money if 220 MHz is opened to CB and they are willing to gamble the money it takes EIA to lobby it through congress and thence the FCC. Morally the CBers deserve nothing at all since they are the worst lawbreakers in the history of radio. If a few law-abiding CBers take umbrage at being lumped with the dimwits, they have themselves to blame for not organizing against the Big Daddies.

UPDATED LETTER

Reference "Letters" page 23 and "Repeater Update" page 12, February 73.

Maybe it is my handwriting, but the call of the South Jersey Repeater on 22–82 is NOT WB2ZQG but WB2ZWQ.

Sorry to cause a mess but I sure would like to get it straight!

I can see it now; now people will tell me I'm I'Ding our repeater with the wrong call!

Bruce Tiemann WB2RUH
Woodlynne NJ

We're glad to see you've made up your mind!

PROTECTION PRECAUTION

Just noticed something in the Feb. issue of 73 that I felt had better be corrected before someone tries it and gets mad. The problem is with the article, "Protection for IC's" by Gene Brizendine W4ATE, on page 142. His basic idea is sound, and definitely a good idea, but his example was not correct. 7400 series TTL logic is rated at an absolute maximum supply voltage of 7.0 volts, says Motorola. Also, if the power supply is used to supply a logic "1" on any device input, the maximum voltage is limited to 5.5V.

With his 7.25 volt zener, the damage could very well already be done before the voltage rises high enough for the diode to conduct. I would suggest a 2.2k resistor in series with the power supply +5 supply as a source of a logic "1" for the TTL logic (only one resistor is needed for up to 15 inputs). Then, use a 6.8V zener in place of the 7.25V one shown, and a fuse of approximately double the average total current in place of the resistor R. This keeps the maximum voltage supplied to the IC's below maximum, and at the same time will cut power before the zener diode can also fail from too high a power dissipation (for example, if the series pass transistor in the regulator shorts).

Keep up the good work. I especially like the idea of Circuits, Circuits, Circuits!

Lee A. Hart WB8DQN
Houghton MI

WE NEED

Can anyone help our club with these items as they are particularly difficult to obtain here: New or recent Callbooks (USA and Foreign), working Vibroplex keys, any new or old radio books and magazines. Anything will be appreciated. Thank you very much.

Kushal Harvant Singh
83 Aulong Road off Stephens Road
Kampong Boyan
Taiping, Perak
Malaysia

20 kHz/1 MHz

We have been among your stronger supporters because of a feeling that you are about the only quasi-official voice that 2m FM devotees have at the national level – in view of the absence of the likes of M. Van Den Branden and ARRL. However, we think you have gone bananas with your suggestion that 20 kHz spacing and 1 MHz splits even be *considered*!

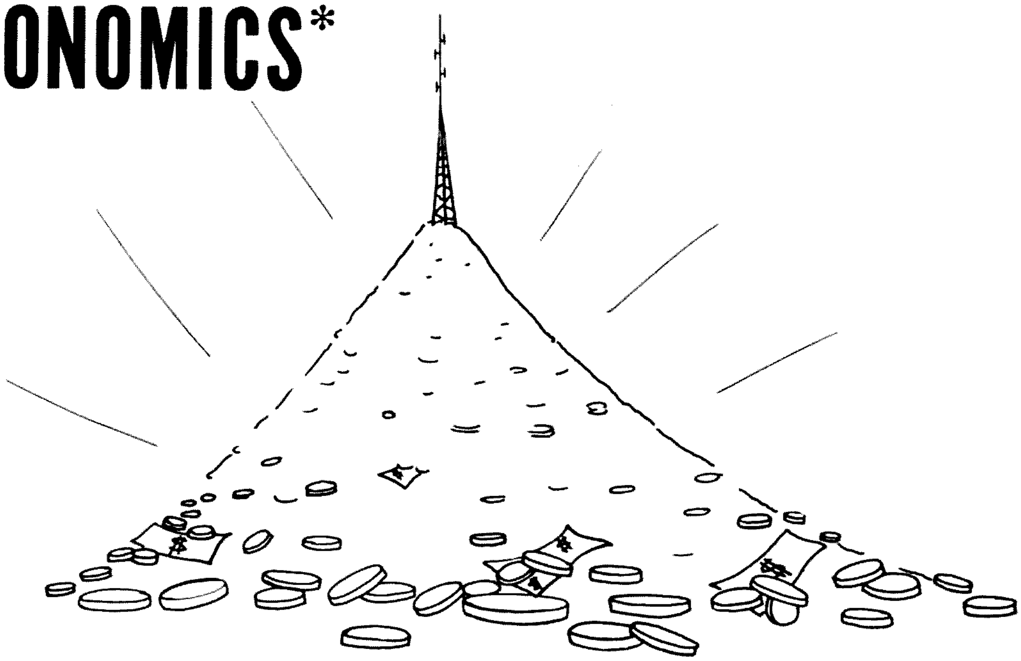
The only force we have going for us in keeping 2m FM from being chaotic and utterly useless to everybody is CONSENSUS. The Texas Plan has just taken hold in most (not all!) areas and made it possible to use the band with reasonably harmonious relationships between and within metropolitan areas. Such harmony and standardization of this channelized operation are absolutely critical to the growth of 2m FM nationwide and to the practicability of this mode to the traveling ham. The degree to which the Texas Plan has been adopted reflects remarkable and unprecedented accommodations made by countless hams who have recognized the long-term benefits to all; this degree of consensus is an extremely rare and valuable development. You are apparently willing to ashcan it casually because you don't bother to even mention this factor.

The case that you have made for 20 kHz / 1 MHz is puny in comparison with the case for rededication to the

Continued on p. 128 . . .

REPEATER ECONOMICS*

Andrew M. Cohn K4ADL
Vice President
Northern Virginia FM Assn. Inc.



**or . . . "There's hills of them thar gold."*

In 1971 in Washington, D.C. there was but one two meter repeater to serve a vast metropolitan area saturated with FMers. Today, six repeaters are fully operational; five more are under construction.

Clearly, technical ability abounds – here and everywhere. Repeater groups become quite psyched up over their creations and perhaps let a very important element slip by: The organization itself. You know, that hopefully large group of members who annually contribute much-needed financial backing for the continued operation and improvement of their machine.

Admitttedly, many effective repeaters are owned and operated by a mere handful, or less. Perhaps they want it that way. We say they must have remarkable wealth or uncanny scrounging ability. We also say it's quite nice to have a solid organization behind the repeater, and for those prospective repeater builders who might share our view, the ensuing discussion may prove helpful.

For a frame of reference, our Northern Virginia FM Association (NVFMA) was the third open repeater to spring up in the Washington area. On the day our machine became operational, about fifty of our one hundred members were already on the roster. In short, we were able to secure a good portion of the necessary funds when we needed them most. While the repeater was under construction we put together an association to provide this backbone. Use the elements discussed to form your own group!

Divide and Conquer

Someone in your group could care less about slaving over a hot iron. We'll pretend it's you. Let the technical wizards do their thing. Resign yourself to the fact that you must spend a little to make a little. And right now, you need a little. Your first step . . .

. . .Up the Organization!

A repeater owned by individuals might be looked upon as risky by prospective members; there is always the possibility of someone packing up his personal bananas and going home. Repeaters and all associated equipment should be the property of the

organization. Then, no member will feel his contributions will be in the hands of one man's whimsy. Form an association and give it a name!

A Rose By Any Other Name

We envied the Detroit Area Repeater Team. "DART" has a sharp ring to it. But here in the Fairfax area, most of us rejected a similar nomenclature for aesthetic reasons. Eventually we decided on NVFMA, only to discover our coverage extended into the District of Columbia and Maryland suburbs. In selecting a name for your association, it is useful to consider the potential coverage of your machine if you intend to solicit memberships from the entire area. Oh, by the way, any attempt to change or gimmick the name once it catches on will be quite an experience in frustration. A rose by any other name is a flop.

The Mailman Cometh . . .

OK so you've picked a name, now how about an address? Your own mailbox may seem convenient, but how will you feel about it when the membership votes you out of office? You'll find just the right size slot for your organization at the local Post Office. The yearly rate for a P.O. box offers a better deal than the quarterly fee. We pay around $10.85 per year for our box, but at least we know our address will outlast any of our officers.

To Inc or Not to Inc . . .

We assume by this time you have drawn up your charter after having elected officers and directors for the association. Whether or not to incorporate is your next decision. NVFMA was fortunate to have on its team an attorney who donated his legal time to draft our application. Normally, he would have received a fee of approximately $350.00. Instead, we simply paid the state's incorporation fee of $48.00. Very likely you will find a lawyer/ham in town willing to do the same, in return, perhaps, for a free life membership in the association. Of course, it is possible to complete the papers without an attorney, but it won't be a picnic. Why incorporate in the first place? No, it's really not worth $350. But it could be worth the $48.00 (depending on where you live) when you consider that in an unincorporated group, all members of record could be held personally liable for any negligent acts of the association. Now that we think about it, maybe $350 is a bargain! Either way, talk it over with someone in the know before you decide. By the way, do not fail to obtain a "finding" from your local IRS office, if you wish to be taxed as a non-profit organization. This has nothing to do with incorporation.

The Membership Fee

In keeping with other area FM associations, NVFMA established a yearly fee of five dollars, plus a one-time initiation fee of the same amount. This works out nicely, since most of the funds are needed early in the game. Decide immediately on either a calendar year or anniversary membership. The former is a bit unfair to the membership, particularly to those who join between July and December. Anniversary renewals keep your organization's secretary on his toes, but insure a steady, year-round income to meet recurring expenses, such as telephone lines, insurance, and so on. You should have no problem finding a local bank offering a non-charge, no-minimum-balance checking account for your organization.

With those formalities under your belt, you are now ready to embark on the biggest advertising campaign Hamville ever witnessed. With name, address membership fee and checking account established, the membership applications can now be printed. Unless you're a survey statistic nut, the forms should contain just enough blanks for name, address, date and telephone. The remaining space should contain at least 25 reasons for joining the association, unless, of course, you have the only football on the block. Whatever you use for selling points, do not promise anything you cannot fulfill.

If you think you can pull in 100 members, order at least 500 application forms. They'll disappear quite rapidly at hamfests, club meetings and radio stores. Most applications we've seen require a crime lab to decipher the faded blue mimeo ink. Try the photo offset process. Give the printer a neatly typed form, camera ready. Those rub-on instant lettering kits will pro-

duce a professional looking form, if you have the time and patience. You might also let the printer do the typesetting for you (for a few dollars more). Be sure he retains the negative or plate for future re-runs. Above all, remember that your application form may be the first contact the FM community will have with your organization. First impressions count.

Membership Cards

Reward new members with a feeling of belonging. Your repeater might not be on the air yet, and the identity-seekers would appreciate any sort of fish you could toss out. Membership cards are usually abandoned in a dark corner of the wallet. Why not get some advertising mileage out of them? We recommend laminated, clip-on cards which can double as name/call tags at meetings and hamfests. The association's name should, of course, be readable at 1000 yards!

Letterheads?

This item may appear to be a luxury. It'll add around $100 to the expense list. Convinced of the necessity, we shelled out the cash personally. Our group did a lot of letter writing soliciting a free antenna site. We had to convince roof-owners we were not fooling around. The letterheads helped.

For the above goodies, you've made your printer $24–36 richer. It will take 3 or 4 new memberships to amortize the cost of the forms, cards and stationery . . .well worth it in terms of organizational stature.

Public Relations

Your promotional activities should serve two purposes: to assure current members that the association's work is progressing according to schedule; and, to lure non-members into the organization. Again, we are assuming you desire a vast roster to provide financial support.

On-the-air talkups are perhaps the most obvious and effective means of getting the word around. Posters and application blanks placed on the counters of local radio stores will help snare the low-banders not yet tuned up on FM. A few hours spent in the production of a massive sign to be displayed at a hamfest booth should pay off with a few more members, but don't get discouraged when only a small percentage of the applications you hand out are returned with a check.

Once the repeater is operational you might want to make use of the "one-way-transmission" provision by putting out weekly info bulletins. This is an excellent way to keep members up to date on the organization's activities, and it's a whole lot cheaper than newsletters. Do not attempt to run opposite Flip Wilson, All in the Family, Laugh-In, etc.; we recommend you consult the TV Guide before scheduling broadcasts. In about 4 or 5 weeks of regular bulletins, most of the members will have caught on.

Dealing with Freeloaders

It is impossible to deal with freeloaders. There is no such animal.

OK, then, Dealing With "Non-Members"

That's better. Once you reach the 100 member mark, the inevitable group of non-member regular users won't bother you too much, until of course the association begins planning for those costly improvements such as split sites and autopatch. The most obvious course of action would be on-the-air and face-to-face pleas for support. You might also consider supplying each officer and director with a stack of membership applications to be mailed out – unsolicited – to these "potential members." Perhaps it will take more than one mailing to the same addressee, but sooner or later he'll take the hint. New stations appearing on the repeater – not knowing where to submit their memberships – would certainly appreciate the application forms.

A Final Suggestion

We have found that the best public relations effort you can make is a friendly attitude toward all users of the repeater. You will come upon many stations who are off frequency, over-deviating, using incorrect procedures, monopolizing the machine, and so on. The biggest mistake you can make is not advising your fellow ham of these difficulties. The second biggest maistake you can make is attempting to correct the poor fellow by lecturing with harsh criticism. Keep it friendly, and you'll have everyone on your side. . . .**K4ADL**

Thomas W. Barefoot WB6QAM
560 Scott St., Apt. B
Monterey CA 93940

INTERNATIONAL SIGNAL'S 100 MILLIWATT RIG REVISITED

I made a modification to the International Signal 100 mW rig that will be of interest to anyone who has one and would like to improve the power output. Several members of the *Naval Postgraduate School Radio Club* have made this modification and no one has experienced any trouble. The problem of the final blowing out at high voltage levels was the thing that got me to looking for a replacement that would stand more dissipation and get greater power out with the drive available from the board. After much searching I found that the 2N4427 (Fairchild) met the specifications except that the case was TO-39 versus TO-52 for the 40637. The new transistor dissipation was 1W at 25°C ambient, while the 40637 was only 0.3W.

The fit in the rig was tight, but the 2N4427 was installed and the rig tuned up. The power out was 250 mW. My batch of ten 2N4427's has a wide range of betas, so it was decided to see what effect the different values of beta would have on the power out. Several different 2N4427's were tried, and the lowest power out was 200 mW and the highest 500 mW; however the average power out was 250 mW.

Since such improvement was made by just replacing the final, I wondered if the driver could be replaced and still more power out be had. This modification was tried with no improvement in power out, so the original driver was placed back in the rig.

Another modification has been made by one of the club members, but I have not tried this, so I can't say for sure how much the power out can be improved. This modification consisted of separating the final and driver stages from the rest of the board and running the final and driver on 12V, with the rest of the board at 8.1V.

The cost of the modification is $1.80 for the new 2N4427 and about thirty minutes of time. I do not recommend using the HEP replacement for the 2N4427 since it is more costly, and from what information I could obtain, it appears that the HEP might require a bit more drive than the 2N4427.

. . .WB6QAM

. . .New Products continued from p. 19.

For instance – the other morning we tuned the band and heard a repeater locked on the air. Just for the heck of it we tuned down to the input channel – something we couldn't have done with a crystal rig – and sure enough, there was a signal on the input! A little work with the beam and we had one leg of a fix on the culprit. All we needed to do after that was find someone else with a Clegg 27B to give another fix!

There are many times when someone comes on a channel and is enough off so the repeater has a tough time with the signal. If you are within simplex distance you can tune down and listen in the input and help to get him on channel.

Now and then it is very helpful when you can work on a reverse pair, talking in private with someone who is coming through a repeater – and this is simple with the 27B.

The 27B has seven front panel controls – two for the receiver tuning and two for the transmitter – a switch to choose the 146 or 147 meg segments – squelch/on-off and volume/spot. One of the two tuning controls switches every 100 kHz of the band (there are crystals in the rig for this) – and the other control is a vernier for the intervening 100 kHz, calibrated every 10 kHz. The calibration is good enough to zip onto a repeater channel with about the same accuracy as most crystals.

In practice you can hit the channel very closely by zeroing it with the receiver tuning and then zeroing in the transmitter tuning on the "spot" position. This uses the repeater output as a standard, and if that isn't good enough, what's the difference?

Once you have the 27B in your car or at the home station you'll find yourself jumping around to all of the repeaters you can reach and widening your circle of friends. You'll skip 52 simplex a lot.

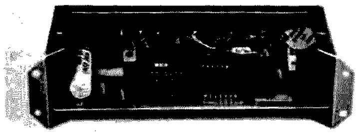
Heaven help us if the FCC sticks to its completely ridiculous concept of permitting simplex contacts on repeater inputs. The 27B makes this practical.

The 27B runs 25 watts output. While this isn't an awful lot more than the normal ten watt output, it is enough to give you the say over someone else with ten watts.

One other thing – the mounting bracket for the 27B has a nice lock on it, complete with key. But unless you make sure the whole bracket is bolted in firmly, you'd better keep your tape deck insurance paid up and the car alarm working, for many thieves just rip the whole works out – and a $500 ripoff is a blow. Quite a few amateurs slip the rig out of the bracket and into the trunk when they park – and most of them still have their rigs.

Remember, for a few dollars extra you can go first class. At $490, the 27B is quite a bargain.

A NEW ID



Control Signal Company of Denver has come up with a nice small identifier unit which sells for only $65, completely programmed with the call of your choice.

There are a bunch of "not only that's" to be added to the above brief announcement. For $65 you might expect to be getting a bare bones ID, or perhaps a kit. No such. This contraption not only is fully built and tested, but the factory sets up your call for you on the plug in IC unit.

The unit is small enough to be used with instant repeaters – or even in the car if you want to fake out your buddies with a professional CW identification while mobile – and who can pass up that eye opener? It operates from anything from 7.5 to 35 volts by virtue of a built in voltage regulator – so you could even use it on a walkie.

It has its own clock built in, so you don't need that old 60 Hz line to get the timing right. It comes set up for 20 words per minute, but you can change this by substituting another small resistor on the board and swing the speed from about five to 30 words per minute. Since the FCC seems to be hot for 20 per, this is a reasonable compromise.

The tone is set at 1020 Hz by the factory, but this too can be changed to anything from 200 to 1800 Hz by changing a resistor. Has anyone done anything about applying those surplus 1020 Hz filters to remove unwanted ID tones from receivers?

The CWID-50 is about 5-1/2" x 1-1/2" x 2-1/2" and weighs in at 8 ounces (how much is that in grams?). That's small and light.

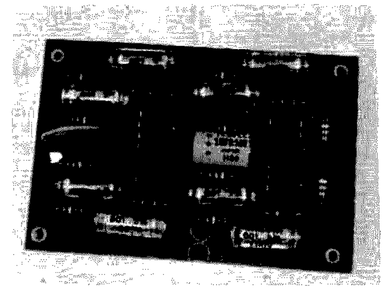
There are three other parameters of the unit which can be modified by a resistor change: the time between identifications, which is set at 3 minutes by the factory, the delay before the ID starts, which is set at 3/4 second, and the length of the bauds, which is set for good copy at 20 per.

Control Signal also has models available for repeater installations which are built on a 19" rack panel and have a built in ac power supply, CW identification for RTTY stations, and etc.

This is quite an interesting development, getting away from the diode matrices which have been used heretofore.

For further information, write the company at *5964 West Columbia Place, Denver CO 90227.* 73 sent you . . . okay?

CW FILTER



A CW filter is on the market that is hard to resist if you need help in the selectivity department. MFJ has a selectable, 80, 110, 180 Hz bandwidth audio filter that utilizes four op amps (2-dual 741's) in a modern design performance package. It will work with any voltage from 6 to 30V and does not require an internal connection to your receiver.

Packaged with the unit was a very complete set of instructions that makes sure you know exactly what you have just purchased, how it works and a number of ways to wire it into your receiver. Although it is noted that excellent results can be had by just plugging the filter into the phone jack, the test unit was wired into an SBE-34 sideband rig.

Since 40m is the only CW band that is covered by the SBE, things were tuned up there. The mechanical filter in the unit affords around 2 kHz selectivity, which is fine for general use but not on the novice band on a Sunday afternoon! Everyone was, naturally, clobbering everyone else. With the filter switched in there was a marked change. Signals that were very close were now individually readable. Even at the sharpest position there seemed to be no ringing as the signals popped through the QRM. A damned good filter! The peak frequency is 750 Hz and is comfortable to copy.

If you are a novice with an inexpensive receiver, or are a higher class licensee that needs optimum CW selectivity, the CWF-2 filter is probably the best buy on the market today. It out performs filters costing twice its price. It sells for the amazingly low price of

$9.95 in kit form, and for $12.95 it comes wired, tested and guaranteed!

For further information on the CWF-2 and other filters in the MFJ line, contact *MFJ Enterprises, P.O. Box 494, Mississippi State MS 39762.*

CALCULATOR KIT

Aries, the kit division of B&F Enterprises, has taken the desk calculator business one step further and has a kit for a pocket device. It does everything that its larger brothers can do but does it with four AA cells instead of a dangling cord. Readouts are LED type so higher voltage is not required.

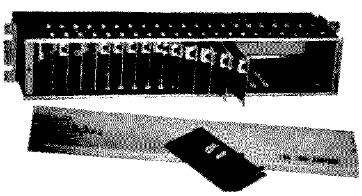
Inside the tiny case is a calculator chip and 40 transistors (27 are used as readout drivers). Packaging problems are taken care of by the use of well designed printed circuit boards. A large amount of space is saved through the use of an elastomer keyboard. Without it the size would probably double.

If calculators are great to use, a hand-held unit can only be better. (Just look what Handie-Talkies are doing to FM!) Take it with you and calculate everything!

The Pocket Calculator kit, complete with alkaline cells, sells for $75. A companion charger with four nicads is available as a kit for $17.50.

Aries Inc., 119 Foster St., Peabody MA 01960.

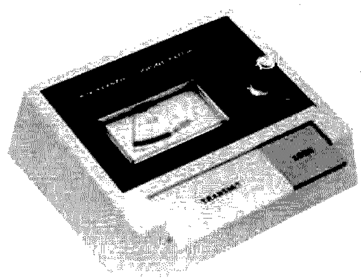
REPEATER TONE PANEL



ALPHA announces its new RCP-780 multi-frequency repeater tone panel for use on community repeater systems, shared base station systems or where tone control of numerous functions is required. The unit is capable of handling up to 18 separate tone controlled functions utilizing a modular plug-in card for each function.

All tone encoding and decoding circuits utilize ALPHA thick film hybrid chip modules that plug into the individual carrier cards making field repair or reconfiguration extremely simple. Each tone card plugs into mil spec gold plated connectors and all adjustments and indicator lights are at the front edge of the card for easy access. For additional information call or write *ALPHA ELECTRONIC SERVICES INC., 8431 Monroe Ave., Stanton CA 90680 (714) 821-4400.*

PHONE PATCH



New from Radio Shack is the Realistic Phone Patch at a price which brings this useful accessory within the reach of any ham's budget. The Phone Patch is priced at $19.95 and comes complete with 15 foot telephone leads, three foot transmitter lead and installation instructions. It features a built-in VU meter, gain control and locking push-to-talk bar. It is available at Allied Radio Stores and through Radio Shack Authorized Sales Centers.

100% SOLID STATE

Swan has come out with a high power 5 band all solid state transceiver. Goodbye mobile power supplies! Featuring no-transmitter tuning, the new unit has broadband transmitting circuits covering 80 through 10 meters. Ready to go by simply flicking a switch, the unit operates on upper or lower sideband or CW modes.

Swan's new solid state transceiver comes in three different power ranges, 15, 100, or 200 watt P.E.P. and incorporated is full VSWR protection from an open to a short circuit.

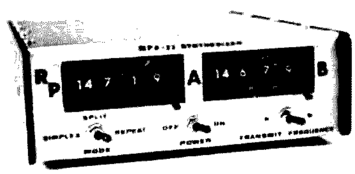
Other features include front mounted controls for easy use and a built in VOX provided with variable VOX gain and Anti-trip controls. Standard with the units is a built-in noise blanker with a variable noise blanking control. They also have CW semi-break in with a CW monitor, a 25 kHz crystal oscillator and an external VFO connection with switching control.

Prices range from $579 for the SS-15, while the SS-100 sells for $699 and $799 buys the SS-200.

The transceivers operate from 12V dc so two power supplies are available for 115V ac operation. The PS-10 will supply the SS-15 and SS-100 and sells for $89. The SS-200 requires a bit huskier supply, the PS-20 which runs $139. Both supplies are part of a companion speaker package.

For more information contact: *Swan Electronics Corporation, 305 Airport Road, Oceanside CA 92054.*

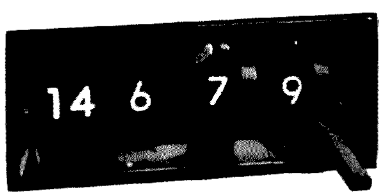
THE RP SYNTHESIZER



RP has done it. They've come out with the first two meter FM synthesizer for both transmit and receive that has the flexibility that most operators have been looking for.

The MFA-22 does just about everything you could want. First of all, it uses some brand new leverwheel dials – a dial that has the readability of a counter dial, and yet is operated with a small lever. The mobile operator will be able to flip this dial easily, even in the dark or with gloves on.

There are three basic modes of operation – simplex, split and repeat. In the simplex mode you transmit and receive on the same channel. You can



A close-up of the leverwheel dials.

set up channel A and channel B and switch between the two, simplexing each. This gadget should certainly help to get the hordes off 94 simplex. There just is no need for ever having to put up with interference when you have flexibility such as this synthesizer affords.

The unit covers the entire two meter band, so the chances are that we may see more simplex operation moving down into the 145 segment – maybe even the 144 segment, a veritable desert in most areas of the country. This will also greatly simplify the use of remote base inputs in these lower segments of the band. Some repeater groups, faced with the new regulations, are thinking in terms of going remote base and moving the input down below 145 MHz to automatically limit the class of license required to use the station – and thus simplify problems of repeating into the lower phone bands where a higher license is required.

In the "split" position you transmit on one channel and receive on the other. If the repeater split is anything other than the standard 600 kHz with the receiver high, you can use the two channel selectors in this mode. This will enable you to instantly switch to the reverse pair, listening to the repeater input, should you desire. This does have advantages now and then. You can also work into repeaters using odd channel splits such as the WA1KGK repeater in Connecticut with 147.49 in and 146.49 out. More and more repeaters with the 990 kHz and 1 meg spacing are being aired in the major metropolitan areas where the standard repeater channels have been filled up and only the old "simplex" channels are still mostly unused.

In the "repeat" mode you automatically receive 600 kHz higher than your transmitter is set. This is extremely handy when you are operating in the car and want to find out if you are in range of a repeater. You have only to switch the transmit channel and give a short call – if you hear the squelch tail coming back you know you can use the repeater. It would be difficult to drive and try the repeater channels if you had to operate both transmit and receive switches for every channel.

The MFA-22 will work with virtually any amateur FM transceiver, which includes 6, 8, 12, 16, 24, 48 MHz transmitters and receivers with i-f's on 8.7 – 10.7 – 11.7 – 16.7 MHz.

Interconnecting the unit is fairly simple, with a small hole having to be drilled in the transceiver rear apron to allow the two small coax lines and power wires to come in. The whole works shouldn't take over a couple of hours.

And how much does this lovely gadget cost? About the same as crystals for 35 channels – only $275. You need this many channels just for repeaters in New England or around New York – and you need more than that if you want to oeprate both places. Likewise California. And, unless the FCC refuses to give decent repeater rules, you'll need lots more channels everywhere.

RP Electronics, Box 1201, Champaign IL 61820 will send you more info, unless you'd rather get a unit right now and read the info later.

KEYER MEMORY

A large capacity programmable-reprogrammable CW message memory, designed as a plug-in accessory for the EK-420 keyer, has been released by Curtis Electro Devices. The standard MK-420 offers a solid state memory capacity of 100 Morse characters. A second optional, 1,024-bit plug-in memory doubles this capacity. The memory organization is switch selected to yield four different program arrangements so different programs may be stored in back quarter of the memory.

Programs are selected and started by pushbuttons; terminated by a message pause or by manual break-in. A 1–20 second repeat feature allows send and wait operation.

Memory programming is accomplished simply by sending the desired sequence in the "record" mode. Messages may be written as often as desired and stored indefinitely.

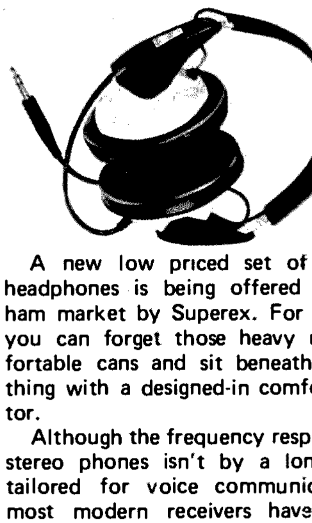
The MK-420 is priced at $299.95. The optional extra memory is $34.95. Contact *Curtis Electro Devices, Inc., Box 4090, Mountain View CA 94040.*

CEI STANDARD TIME RECEIVER

Now you too can get automatic accurate time announcements from your repeater. The WA1KGO repeater group had been looking for an easy way to have time announcements on the repeater. We wanted an automatic unit that would announce local time. However, the only unit we could find was a receiver with a built in recording that would announce the time when a button was depressed. The unit cost a staggering $150 and it was subject to error should power fail. A quick telephone call to Hamtronics in Trevose, Penn. gained us the new Caringella STR-1. It is a three channel solid state receiver for 5, 10, and 15 MHz for WWV. Or, the unit can be supplied for the 7 meg CHU frequency. A quick trip to the WA1KGO repeater site and we hooked up the STR-1 to the repeater so that it would announce the time on command through an 1800 Hz tone burst. After the time announcement the repeater returns to normal use. Naturally, the STR-1 has many other uses around the shack or office. At the 73 offices we have 11 digital clocks. When we lose power for a second or so each clock has to be reset. The STR-1 certainly makes the job easier.

The STR-1 is available either in kit form or wired from *Hamtronics, 4033 Brownsville Road, Trevose PA 29047.* Be sure to specify WWV or CHU.

SUPEREX HEADPHONES



A new low priced set of stereo headphones is being offered to the ham market by Superex. For $19.95 you can forget those heavy uncomfortable cans and sit beneath something with a designed-in comfort factor.

Although the frequency response of stereo phones isn't by a long shot tailored for voice communications, most modern receivers have bandwidth filters and shaped audio sections that limit audio response and nullify the need for tuned phones.

One plus in the favor of these headphones is that the two phones are already electrically separate. Use one side to listen to a QSO in progress and connect the other to a second receiver and look for 20m DX. It's amazing how well the human ears can function independently of each other.

For more information on the "Newport," contact *Superex Electronics Corp., 151 Ludlow St., Yonkers NY 10705 (914) YO5-6906.*

.... W2NSD/1 Continued from page 5.

The situation seems to be this: part of the nuclear standoff with the Russians appears to be an agreement not to even try to provide any defense measures for the citizens. In return for this, the Russians are expected to reciprocate. By leaving the populations of the two countries unprepared to cope with nuclear war, the standoff results, with each population being held as hostage by the other.

This system seems to work. At least we haven't had the war yet.

I don't recall being asked to agree to this system, and as an involuntary participant, I don't feel all that guilty if I hedge a bit on the agreement. If you feel the same way, perhaps the following may interest you.

Let's suppose the worst does happen. It could happen by accident – shades of Dr. Strangelove. It could come about through a third party such as China. Somewhere between 50% and 75% of our population would probably be wiped out – perhaps even more. These are the estimates that seem to be accepted by our government.

If such a disaster should come there would be little in the way of communications other than amateur radio. Some of the VHF services could handle purely local traffic, though (as we have found in our run of the mill disasters) each service would probably be too busy with its own communications to provide any help for the population. Even simple things like floods and earthquakes quickly show all existing communications systems to be virtually worthless. Only amateur radio is capable of providing both short and long range communications.

It seems to me that it behooves us to keep this in mind when we are setting up our repeaters and other emergency systems. How many of them will work if the chips ever go down? How reliable will they be? How well prepared are we to use the systems we have set up?

The recent FCC rules on repeaters will make our job of setting up emergency systems many times as difficult – for no obvious reason. This is unfortunate and perhaps we should build in some sort of "A Day" override for the hamstringing requirements of the new regs. Of course there have to be some tests of the full systems – it will be a little late if we wait for it to happen before we start trying to learn how to use things.

Reason dictates that FM repeaters should be able to interconnect with low band transceivers for combined short and long range traffic. Reason dictates that repeaters on the various VHF bands should be able to interconnect so six meter ops can talk with two meter ops, and with 222 MHz ops – and even with 450 MHz ops. It seems to me to be irrational to have it any other way.

One of the main points where the FCC and I are at odds is that I feel we should be able to set up our repeaters with these systems right now and have them operational. I feel that if there is any pressure for holding down the number of channels in use that this will be felt and economy will follow, that it is not right for the FCC to limit our experimentation and development in the name of possible future channel congestion.

Now I do not suggest that the FCC is part of a conspiracy to prevent adequate civil defense, though they could hardly be much more effective in that direction even if they were consciously working toward inhibiting the development of amateur radio emergency systems. It is extremely unfortunate that the FCC has now set a pattern of turning a totally deaf ear to every plea and request for relief from their overly restrictive rules.

Should the ultimate emergency occur we will need every available aspect of amateur radio. We will need repeaters – every mobile and hand unit we can find – we will need emergency power – sideband rigs to interconnect communities and countries – RTTY for fast message handling – and we will need a measure of cooperation far beyond anything we have ever experienced.

Frankly I would like to see repeater clubs and radio clubs accept the responsibility for preparing for emergencies. I would like to see each club establish one man as an information center – a man who would inventory emergency equipment and personnel available – who would coordinate amateur radio with all other communications services in his community – who would know where to find emergency generators and gas – who would know who to see to interconnect with all other radio users – etc.

Very few repeaters are set up for true emergency operation and this should be remedied as fast as practicable. One of the first things to go in an emergency is commercial power – the other is telephone service. This means that repeaters dependent upon either are of little value in time of trouble.

Automatic gasoline generators are good, to be sure, but they are also expensive and they have to be fed. In a big emergency you might not be able to get to the repeater site to refill the tank – or you might find gas hard to get. Perhaps a better answer for this is to go solid state with the repeater and have it so it will work from 12 volt car or truck batteries when the commercial power is off. This seems worth some thought and perhaps some articles for *73*.

And how about windmill chargers? Maybe we're getting to the point where we might consider them for repeaters – at least as an auxiliary power source. They could help keep the batteries charged.

We could set up the repeaters to operate at about ten watts while on battery power, with the amplifier being connected to the commercial power.

My apologies for getting into nitty gritty aspects – the main idea of this was to communicate my idea about amateurs having a responsibility to provide emergency communications even though CD does not provide much help or encouragement. As I see it the only truly emergency system of communications that the country has is amateur radio – are we going to face up to this responsibility?

REPEATER COUNCIL SPEAKS

It has been reliably reported that at a recent meeting of a statewide repeater council the repeater groups represented agreed unanimously to keep their repeaters on the air should the FCC deadline of June 30th pass without the new call letters being issued. The identifier would be turned off, but the repeaters would continue.

Perhaps it is about time the Commission started reacting reasonably to the needs of amateur radio and stopped its dictatorial stance.

I predict that the pressures will build up to where the FCC must recognize them and modify some of the recent repeater rules . . . and the interpretations of these rules.

WAYNE vs IRS

Rumors have a way of spreading a lot faster than retractions or denials, so I assume that many readers have heard one or more of the Wayne Green fan club on the air giving a one-sided view of my latest battle with City Hall: the IRS.

The IRS is formidable. They have their own courts – judges – attorneys – and all the money in the world to hassle you. Milton Friedman in a recent *Playboy* feature interview compared the power of the IRS to that which the Russian leaders have over their people . . . "Or even compared in the United States with the power that an official of the Internal Revenue Service has over you. An official of the IRS can put you in jail. I doubt that there is a person in the United States who couldn't be convicted of technical violation of some aspect of the personal income tax."

Continued on p. 123.....

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

HELP WANTED – Assistant Circulation Manager for 73 Magazine, male or female. Must be fluent in English, have proficiency in reading/writing Spanish, and have typing ability. Prefer ham or previous ham, domestic or foreign. Send resume c/o Circulation Manager, 73 Magazine, Peterborough, NH 03458.

2 METER FM – SR-C 145 Handie Talkie Transceiver brand new, complete with carrying case and American instruction booklet. $190.00. Joe Gibson, 181 So. Orchard St., Wallingford CONN 06492.

MOTOROLA HT220 FM Handie-Talkie, factory modified for 2 meters crystals installed for 34/94, 10/70, 20/80, 94/94. Five watt output. Includes case, 5¼" "flex-whip" antenna, 2 rapid charge batteries, automatic charger, external antenna adapter, external speaker/PTT microphone with coil cord. Radio can be used as "miniature" base station from 110VAC. Other non-Motorola accessories included: Dycomm 101-500C 12VDC amplifier (mobile) Calrad 110VAC to 12VDC power supply for base. Will ship all. NO TRADES. Have manuals for all. $700.00. Call daytime only or write: L.G. McFadden, WB6EJQ, 765 Geary St., #311, San Francisco, Calif., 94109, area code 415 474-1394.

WA8TMR deceased. Wife must sell Swan 500CX single sideband transceiver and Power Supply 117XC. Excellent condition. Mrs. John Sercia Box 144, Brookfield, Ohio 44403.

ALL GEAR TOP CONDITION: Hallicrafters FPM 300 SSB xcvr $480. Heath IB-101 frequency counter with Vanguard scaler $250. Heath SB200 linear 2 KW PEP $330. GLB synthesizer, works with any rig, $150. Also Galaxy V SSB xcvr w/p.s., accessory console and ext. VFO, $350. Box 220, 73 Magazine.

NEEDED . . . SWAN 406 VFO (THIS IS THE SMALL PHONE BAND ONLY VFO). PLEASE CONTACT W7DXX/1 AT 73 MAGAZINE.

COMPLETE 36 page QSL catalog, 3rd edition. New "SPARKLING" QSLs. Hundreds of cuts, ten report forms, thirteen colored stocks, 25¢. Ten sample QSL cards. Corneilson's Quality QSLs, 321 Warren St., N. Babylon, N.Y. 11704.

YAESU FTDX-560 Transceiver $400. Heath SB-220 2KW Amplifier $320. Heath IM-102 Digital VOM $150. New TR-44 Rotar $50. Hal Keyboard Keyer $75. Drake MN-4 Matchbox $50. K4KY 3853 Garden Terrace, Owensboro, Ky. 42301, (502) 683-9871.

EVANSVILLE Indiana TARS Hamfest. Sunday May 6, 1973. 4-H Grounds, Highway 41 North 3 miles. For flyer contact Robby W9MKZ, 502 S. Lincoln Park Drive, Evansville, Indiana 47714.

HR-2, twelve channels, fully crystalled, pre-amp, A/C supply, nicad field pack, charger, antenna, $280. 10w/50w Dycomm, $70. Bruce Berg, 13 Lisa La., Cherry Hill, N.J. 08003.

WANT HT-220's – best prices paid – now's your chance to get enough to buy a six channel fast charge Japanese HT. Give details and price first letter. Box 95, 73 Magazine, Peterborough NH 03458.

2 METER FM - YAESU FT-2F .8 and 10 watts, good condition $170.00 or swap for Drake TR-22 WA1JUV, 452 Livingston Drive, East Windsor, N.J. 609-443-1155.

CANADIANS FREE 120 page Electronics Catalog ETCO-B, 464 McGill Montreal.

WANTED: Parts for or cannibalized General Electric Voice Commander II's and III's; WAØJUM, Box 59, Mobridge, SD 57601.

MOULTRIE AMATEUR RADIO KLUB, 12th Annual Hamfest, Wyman Park, Sullivan, Illinois, April 29, 1973, Indoor-outdoor market. Ticket donation $1.00 in advance – $1.50 at the gate. For information write M.A.R.K. Inc., P.O. Box 327, Mattoon, Illinois 61938.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

6 MTR HA-460, Squalo, Xtal, cables. 20 Watts, VFO, etc. $115. Swap for 2mtr FM? Steven M. Hager WA2UBY, 45 Fleets Cove Road, Huntington, New York 11743.

HERE'S YOUR CHANCE. HR2MS 8 ch. scanner 15W $255. TME-H-LMU 16 ch. scanning rcvr 6/2/¾m $255. Digital logiclock $75. Tempo CL220 12 ch. $265. Everything brand new. Box 310. 73 Magazine.

DES MOINES HAWKEYE HAMFEST will be held on Sunday, June 17, 1973 at the Iowa State Fairgrounds. Plenty of free parking. Flea Market, covered display booths available, small charge; open arena – no extra charge. Dealer displays, prizes, and XYL activities. Saturday night Auto races and camping – extra. Registration $1.50 advance/$2.00 at gate. Write Des Moines Radio Amateur Association, Box 88, Des Moines, Iowa 50301.

ANTIQUE radio equipment sale and swap session, dinner and program, A.W.A. Spring Meet, April 7, Canandaigua, N.Y. Write for details: Lincoln Cundall, W2QY, 69 Boulevard Parkway, Rochester, N.Y. 14612.

PRINTED CIRCUIT NEGATIVES MADE. SASE AND QUARTER FOR INFORMATION/PRICES. P-C NEGA SYSTEMS, 186 - 80th STREET, NIAGARA FALLS, NEW YORK 14304.

HOOSIER ELECTRONICS has the best deal around on the ham gear you want. Write us for a quote and try our fast, friendly Hoosier service. Factory -authorized dealers for Regency, Drake, Standard, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Hustler, Mosley, Ham-M, Bowmar Pocket Calculators, plus many more. Orders for in-stock merchandise shipped the same day. Write or call us today for our quote and become one of the many happy satisfied customers of Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana, 47802. (812)-894-2397.

2 METER FM CHEAP? Will convert your 2mtr Gonset III for 2 meter FM – $35.00 plus shipping. Jim Gysan W1VYB (617) 922-3850.

22nd ANNUAL Dayton Hamvention will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt, flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. M, Box 44, Dayton, Ohio 45401.

HT-220 two watt two channel with case – best offer over $75. Box 12, 73 Magazine, Peterborough NH 03458.

DESIGN 1 to 300 MHz parallel resonant circuits. Find Q, inductance, capacitance, turns, etc. rapidly. 19 scales, durable plastic coated slide chart. Guaranteed. Send $2.75 to ComRec Company, Box 93, Penacook, New Hampshire 03301.

CLEANING SHACK – General Electric MA/E 36 w/4 frequency deck. Independent T & R frequencies, with 3 sets crystals and spare vib. P.S. $125. Aerotron 6n100/MA Amplifier, 3–15 watts in – 80 to 110 out. With spare 5894 tube (new), $75. Hammarlund FM-50a with 34/94 and 94/94 crystals ac/dc P.S. 25 watts out for only $50. All items are in good working shape. Rob, WB2ATX (201)224-9659.

WANTED: OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave N.E., Kirkland, Wash. 98033.

SALE! Pwr supply containing 105,110,115 in, 3200VCT@ 1a, Swinging, fixid chokes, filter caps, fil trans for 4 large Hg rect., mounted on a heavy steel frame. 1 extra plate trans as above. 28V@200A gen. 6 ft open rack. Dynamotors – all sorts – 6 to 28 in, 300 to 1000 out. ARC-5 transmitters. Model 15 and many spare parts. Motorola "coffins." Much hi-power supply parts. If you don't see what you want, ASK. W5EIX, 1224 Comanche, Richardson, Texas.

DRAKE, T4XB, R4B, MN2000, AC4, MS4. All excellent condition. $600.00 for all or make offer on individual units. WB6CDU, 8302 Rathburn Av., Northridge, CA, 91324.

GE, Pocket Mate. 1W out on 146.94. Smaller than HT220. With nicads, antennas & manual. $200.00 ppd. WB6CDU, 8302 Rathburn Av., Northridge, CA, 91324.

HALLICRAFTERS SR-150 & PS-150; $275: Gonset 3212 2 Meter Power Amplifer; $125: Poly-Comm 62-B; $100: All in good condition with manuals. W2WRI J.A. Kammerer 23 New Street Katonah, N.Y. 10536 (914-232-8349).

"DON AND BOB" guaranteed goodies. SBE450 339.00; Gladding 25 212.50, with AC 255.00; Write quote Standard 836MA; Standard 146A; Cetron 572B 13.95; Mallory 2.5A/1000PIV Epoxy Diode 29¢; MOT MC1709CG OPAMP (709) TO5 39¢; K765 Code ID with plastic wheels 5.95; Calrad KW Dualmeter SWR Bridge 15.95; Write quotes Drake, Triex, Eimac, Midland, Hygain, Mosley. Used Collins 30L1 395.00; Collins 75A4 345.00; Prices FOB Houston, items guaranteed. Mastercharge, BAC. MADISON ELECTRONICS, 1508 MCKINNEY, HOUSTON, TEXAS 77002 (713)2242668.

MODERNIZE FOR PEANUTS! Frame & display QSL's with 20 pocket plastic holders. Two for $1.00, seven for $3.00. Prepaid, guaranteed. Universally used and approved. Order now. TEPABCO, Box 198S, Gallatin, Tennessee 37066.

FOR SALE: Swan 270 B, mint condition, with original shipping materials, $250.00. Clegg Thor with A.C. supply, $70. (615) 524-2693.

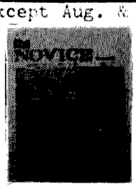
WANTED: authentic railroad telegraph key. Pay cash or swap antique radio items. WØHKF, 1212 Bellows St., St. Paul, Mn. 55118.

TECH MANUALS for Govt surplus gear, only $6.50 each: R-388/URR, R-389/URR, R-390/URR, R-220/URR, R-274/FRR, CV-591A/URR, URM-25D, TT-63A/FGC, SP-600JX-17. W3IHD, 4905 Roanne Drive, Washington DC 20021.

$45 COLLINS Model MBF xcvr. 6 meter SSB. David Ganezek, 2216 Camden Ave., L.A., Calif. 90064. WN6SQ6.

GREATER BALTIMORE Hamboree will be held Sunday, April 8, 1973, at 10 AM at Calvert Hall College, Putty Hill and Goucher Boulevard, Towson, Maryland (1 mile south of Exit 28 Beltway – Interstate 695), Food Service, Flea Market, Prizes, REGISTRATION $2.00. No table charge or percentage. Info: Joe Lochte, 5400 Roland Avenue, Baltimore, Maryland 21210.

HW 100 mint condition with homebrew power supply, $260. Will ship. Box 984, 73 Magazine, Peterborough NH 03458.



Peter J. Cacciotti WA2DDT
530 Lee Drive
Corapolis PA 15108

CURLY COIL FORMS

Having finally solved the problem of an inexpensive and readily available coil form, I thought I would pass on the idea to my fellow hams in the hope they too will find it useful. The procurement of these forms is not without its dangers, as they belong to the XYL. The forms of which I speak are my wife's hair curlers.

After having tried the usual coil forms, cardboard tubes, plastic pill bottles, and having tried "sewing" one together (a complete fiasco), I found the hair curler. They come in various diameters and lengths and are made of plastic. My wife's curlers have small teeth and these helped the spacing in the coil turns. They also have holes aplenty through which wires can be run.

When coupling coils are needed, the hair curlers work nicely, as they fit one inside the other. Unlike the ready-made store-bought coil form, there seem to be plenty of hair curlers around when they are needed, and – oh, yeah – if the XYL is deserving, you can let her do her hair up in your coil forms. . . .WA2DDT

. . . W2NSD/1 continued from p. 119

It all apparently stemmed from a little booklet that I wrote several years ago telling people how to make money, if that was their bag. Toward the end of the booklet there was a small section with ideas for tax loopholes to help you hold onto the money once you make it. This appears to have been a red flag to IRS.

Those of the readers who are company presidents understand that you hire bookkeepers and accountants — they prepare your tax forms and you sign them. The sticker here is that if they make mistakes you are the one who is threatened with jail, not them.

The first inkling that there were any serious problems came recently when the Manchester Union (you may have heard of this unusual paper) had a story of my being indicted for income tax evasion. Obviously I needed a lawyer. Some local FM friends recommended a man with experience in this field and he quickly asked for some sort of explanation from the IRS. The upshot was that the case was postponed indefinitelv.

Eventually we may be able to find out what the IRS is griping about, but apparently some of my enemies have judged me guilty and have gone so far as to tell people I was in prison. I must give them credit for diligence, for copies of the newspaper article have appeared everywhere.

It is interesting to me that, contrary to the expectations of my competitors, the reaction has not been all that negative. Apparently the IRS is disliked — quite a lot.

I suppose that I should extend my thanks to those who have gone out of their way to PR us. My thanks to Skip Tenney of Ham Radio for an outstanding job. Dick Cowan of CQ deserves the highest praise. And Harry Dannals, the president of ARRL, should be congratulated for his untiring efforts on the air and off. What would I do without my fan club?

SUGGESTIONS SOLICITED

Recently, after having been on two meter FM for several months, I got the low band station working again and sat down for some twenty meter work. Down on the low end there were a few pileups. I shouldered my way into a couple — got my signal report and the call of the QSL manager — made a note on my DX log sheet of updated contacts with the countries involved — and tuned the band a bit more.

Is this it? Is this hamming?

I listened some more. I listened to the pileups and, time after time, I heard a frustrated DXer clobbering the channel to get through — then telling the DX station that this is the second or third — or umpteenth — time he's worked him, that he is still using the same gear, he wishes him and his family well for whatever holiday is at hand or nearing — thanks for the QSL — 73.

Is *this* it?

Sure I realize that the DX hound who has never learned to talk on the air has to stick to working the pileups, and if he has already worked the object of the pileup, he still has to get through to gratify his ego — to do his thing. This is hard on the fellows who haven't yet worked the rare one — and it is hard on the DX operator too, for there is nothing whatever in such a contact for him. If he wants to give his rare country to needy ops, the DX hog frustrates him as well as those trying to get through. If he would rather have a more meaningful contact, he is still frustrated.

Have you any suggestions?

CB SOLUTION

Doesn't it seem reasonable that the FCC could solve the CB problem at any time it really wanted just by asking amateurs to step in and help? There are hundreds, if not thousands, of amateur clubs and groups which would be delighted to set up CB hunts and pinpoint the lawbreakers and bootleggers on 11 meters.

The CB line is beginning to be heard from the Commission halls in Washington — the line that citizens deserve to have frequencies for yakking. Perhaps this is why the Commission appears to be taking such an incredibly soft line with the illegal call signs — illegal power — illegal operation between channels — illegal language — illegal antennas — illegal skip contacts — illegal rag chewing.

CB CORRECTION

One reader called to point out that the piece about retuning CB rigs (Feb.) for better output neglected to mention that the slugs in the coils and i-f transformers often work themselves up and that a small hex wrench is most valuable for tightening these slugs down. These are in the centers of those little square cans and the little plastic round things — some have screwdriver notches, some hex holes. To bring in those skip signals, tighten all those loose slugs down.

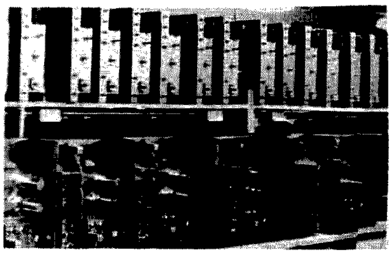
GETTING RICH IN AMATEUR RADIO

Outside of going on commercial DXpeditions or publishing lucrative ham radio magazines, the main way to make amateur radio pay off is by getting into the manufacturing end.

Before you make that down payment on a new yacht, you will have to decide what marvelous product you are going to make and be back ordered on for the next few years. Five kilowatt linear amplifiers might be a good item, except that the CBers would take all you could possibly afford to make and you wouldn't be able to even begin to supply the hams. Perhaps something in FM, since the CBers haven't discovered that yet.

The Fun Mode certainly seems like the way to go for 1973 . . . and 1974. The growth of interest (and sales) of FM equipment shows no sign of doing anything but going up. About 20% of the active amateurs are presently active on FM. By next year this could easily be up to 30% and, if even half of the possibilities of FM development are realized, this could eventually get up to 80% or better! Active amateurs are going for FM even faster than they went for sideband!

The manufacturing possibiliies for FM are myriad. Hand units will be selling faster than they can be made for a long, long time. Soon you will see hand units sticking out of most of the ham pockets or slung on the belts at hamfests and conventions. Club meetings will be QRM pileups on the club repeater channels. It will all spell FUN.



Ever envision your back-room workshop looking like this?

We need inexpensive solid state low power repeaters. I would suggest that they be made in two units with a 600 ohm line between for split site use or telephone line use. We need interface units for repeaters to phone lines, touchtone or dial. We need little touchtone pads to use in cars and even on hand units. We need synthesizers. We need channel-alert receivers to tell us which repeaters are in use. We need selective calling systems so we can call individual amateurs or be called through any repeater. We need shirt pocket transceivers and small booster repeaters. The list goes on.

Other areas of increased amateur interest are slow-scan television, QRP CW, repeaters for RTTY and ATV. Slow-scan holds great promise, in particular. Look for a lot more manufacturers of slow-scan equipment and accessories.

Okay, you've decided to try a new product . . . you've got a prototype and have gotten lots of encouragement from friends . . . you've priced it out and find that you can sell it at a

reasonable profit . . . you're ready to get going commercially. You'll need some expert advice on how best to merchandise, whether through distributors or via mail order.

The best of products can fail miserably if you don't advertise it right and in the right magazines. Is your item primarily of interest to Collins owners . . . the old-timers with money and not too much interest in newer things? There is a ham magazine ideally fitted to your products, one that will bring you the most sales per advertising dollar spent. Perhaps you have a cheapo gimmick and need a cut rate magazine read by kids . . . there is one! Maybe your item will be of major interest to super-technical engineers and fellows who believe in building instead of buying . . . there is a magazine. These are all exaggerations, of course, but not big ones.

If 73 looks like your best bet for introducing your product, give us a call. We'll help you with your marketing problems, with advertising, and try to help you get information on your product to as many amateurs as possible.

Who knows, perhaps you have something that I might like to try out personally and write about. As far as I know, I am the only publisher or editor of a ham magazine today who is on the air regularly and who is trying things out himself. I am on the air almost every day, as users of virtually every New England repeater will affirm.

DESK CALCULATOR

Long having been a big fan of the Monroe calculator – to the extent even of having had it at one time mounted in my car for use on rallies – it was only a question of time before I got into the new IC powered jobs which are turning up in all of the magazines – including *73*.

The Heath unit seemed like an excellent way to go, so we tried that. You know, it's funny, but you can go along without something for years and never really suffer much – then, suddenly when you get it, you use it every day – often – and you wonder how in the world you ever got along without it.

The Heath frequency counter with Vanguard scaler is a case in point. A day doesn't go by that this combo doesn't get used. We whup transceivers onto the channels we want at the slightest whim now. Going to New York? Okay, let's put in 13–73, 40–00, and a couple other good New York channels. Boston? Fine, where are the 04–64, 07–67 and 39–99 crystals? Manchester? Hmmm, 34–94, 19–79, 25–85, 37–97. And etc.

The Heath calculator is used even more than that. Constantly. For all sorts of things. For instance, a book just came in from TAB Books – nice one – "Handbook of Electronic Tables." It is a 223-page book ($7.95 hardbound, $4.95 paper) full of tables. But with the desk calculator all I need is the formula and I can get the same number without 223 pages.

It is difficult to figure just why I would want to know the area of the hole made by a 1/32'd inch drill – but there it is on page 203. A couple of quick punches with the calculator and I have the same answer. Wild.

Frankly, the ads for all the different calculators are a bit bewildering – with the big price differences there must be some advantages to the more expensive ones. Perhaps a reader will be able to write an article giving us some of the basic differences so we will all understand more about this. It is a little bit off of amateur radio – but it is IC technology and few of us do not have a need for calculators. And we also like to have the answers when talking with friends – they expect us to be knowledgeable when it comes to electronics.

A recent visit with SM7BOZ turned up a new midget calculator which will be selling for under $75. I'll have to get a couple of those when they get to the U.S.

JORDANIAN FILM PROJECT

The response to the proposed project to make a film of the amateur radio program in the Jordanian schools has been good. This was mentioned in the February editorial

The plan is to use the schools of Jordan as an example for other emerging nations to encourage them to set up amateur radio stations as King Hussein has in Jordan. No nation can really develop without communications – and you need people for this – people interested in radio and communications – people to design – to build – to install – to operate and to service the radio and communications equipment.

And what is the best way in the world to get people interested in radio? Through amateur radio, obviously. This has sparked the idea of seting up ham stations in the high schools in order to attract teen-agers to the hobby – and to careers in electronics.

Jordan is the first country to try this idea and it is working very well there. In order to get this idea around to more countries it is important to make the results achieved in Jordan known – and to this end we want to produce a film which can be shown throughout the world. Dave Bell, the chap who has made the recent ARRL distributed films, has volunteered to work on this project as a labor of love – which means that money is needed largely for film and processing costs – plus transportation.

The largest donation so far was received from Bernard Brink KØYSK/6, who sent in $200. How about it fellows – here is an excellent opportunity to do something for the entire world – and to help amateur radio to boot.

WAYNE GREEN AS A SPEAKER?

There are far more requests for me to speak at dinners, hamfests and conventions than I can possibly handle and a general policy has evolved to cover my speaking engagements.

To keep personal expenses down, the costs of transportation and accommodations should be taken care of by the sponsoring club. To repay *73 Magazine* for my lost time the sponsoring club should agree to pre-sell a minimum of 50 one year subscriptions to *73*. To provide sufficient time for me to give a talk and answer questions, there should be at least two hours available on the program.

I will be delighted to talk on any or many subjects – you name it or leave it to me.

NOTIFICATION OF ADDRESS CHANGE

Recently we had occasion to cross check the latest FCC addresses with the addresses we are using for 73 subscriptions and we were surprised to discover that a substantial percentage of amateurs have moved without notifying the FCC. The Commission takes a dim view of this method of saving $4 . . . and that would seem to be the logical explanation for so many not notifying.

When you move you are required by the amateur regulations to notify the Commission – and you have to do this on their 610 form – and this is a modification of your license and costs you $4. You can renew your license and change address at the same time for the price of a renewal: $9.

Also, if you are active on FM, or even might become active, it costs you nothing extra to also ask to be listed as a control station at the time you renew your license. If you do it as a separate modification, it's $4.

ARE YOU REALLY INSURED?

Just because you have been paying premiums for insurance for many years does not mean that you have the insurance you think you have.

Take the case of one amateur who had his home broken into and had all of his ham gear, hi-fi, fur coats, silverware and appliances removed. It took a full year to get the insurance

Continued on p. 128 . . . . .

Robert Suding WØLMD
189-3 Crenshaw Court
Tallahassee FL 32304

WILLIE AND THE SSTV

Is this a camera which I see before me,
The lens towards my face? Come, let me activate thee.
I have thee ready, yet I see no light spot.
Art thou not, cathode ray tube, sensible
To wishes as to pulses? Or art thou but
A camera of the mind, a wished-for FSS,
Proceeding from the television-oriented brain?
I see thy pulses not, yet in acceptable gray scale,
With this slow scan camera now I scan!
Thou marshall'st me the way I should be transmitting,
And such an instrument I am to use.
Mine eyes are made weary of the flickering phosphorus,
And I would pull the plug: yet I see these still,
And on thy iridescent face dudgeon gouts of P7 radiation,
Which I can do without. It is such a thing,
This bloody scanning business which transmit
Thus to the world. Now o'er my bleary eyes
Sleep steals softly; yet incoming rasters abuse
The longed-for sleep; K4TWJ celebrates
Pale WØLMD's offerings and W9NTP, etc.
Alarum'd by the qrm, the wretches,
Whose hardsell or whose stealthy pace,
With FM's ravishing strides, towards better solid state design
Moves like a ghost. Thou sure and firm set the status quo.
Hear not our splatter, which way they go. for yet
The very qrm'ers rally to us about,
And take the present mystery from the "machine,"
Which now extends us so. While I scan, no other does,
And pictures to the heat of deeds too cold breath gives.
I input, and it is done; the distant pictures invite me,
Hear it, status quo: for it is the knell
That summons thee to televise or to Hell.

...WØLMD
(with apologies to Wm. Shakespeare)

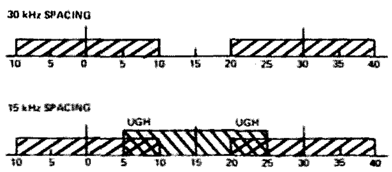
... Letters continued from p. 100.

Texas Plan. Hundreds of functioning repeaters attest to the feasibility of 600 kHz splits... Probably one FM'er in a thousand has a synthesizer which you claim is a "reality." We have never heard of a crystal manufacturer offering to "shove" crystals that hams might send back to them. We are aware of no indications that good crystals are "much" cheaper nowadays. Commonly-used equipment WILL cover 1.5 MHz spreads with inconsequential performance penalties. 15 kHz spacing obviously provides more channels than does a 20 kHz plan for the relatively few severely congested areas of the country. There certainly is some truth in your claim that 15 kHz spacing creates problems for receiver designers, but isn't it just this sort of frontier that provides the element of technical challenge that is an important facet of ham radio? Simplex operation below 146 MHz, with repeaters up to 147.98, actually requires greater than 2 MHz spreads in transceivers – or are you assuming that these simplex types of hams are completely different people from repeater users? Multiple repeater outputs during changeover is illegal under FCC rules. Our observations (covering numerous areas of the country) indicate that, nationwide, simplex operation constitutes more like 40–50% than the 5% you guestimate.

Terry A. Philpott KØEGW
Charles A. Fenwick WØFTM
Alvin H. Groff KØVQM
Donald K. Grimm WAØWJM
Cedar Rapids IO

While I have no desire to get into hassles over one meg splits and 20 kHz vs 30 kHz separation, I do feel a responsibility to bring these questions before the readers. When I have come to the point where I am deciding what everyone should do – and start censoring ideas and preventing their publication – then my usefulness will be diminishing. On this basis I am at odds with you, for I gather that you are opposed to anyone even thinking about ideas that you do not agree with.

Re ashcanning consensus – to the contrary – it appears to me that the consensus was arrived at by everyone considering all of the factors involved. Now, if we have other factors emerging, I see no reason why a new consensus cannot be reached. We've proven that we can agree – and we have no proof that we cannot introduce changes into our agreements.



The pattern that I see emerging is one which will be straining the consensus – and this is what must happen when the consensus no longer is adequate. In areas where the 600 kHz channels are all occupied on a 30 kHz separation basis we see more and more 15 kHz splinters and more and more one meg splits. The fact is that the consensus was fine as long as it provided enough channels – and it worked perfectly in most areas. Once the consensus no longer works it is ignored.

Now, on some of your other comments – synthesizers are beginning to arrive. We have two on test at 73 and more are coming – they will be a factor eventually. Crystals? Excellent crystals are available for virtually every ham transceiver for under $4. The 15 kHz receiver problem will take more than new designs. Using the present 5 kHz deviation standard, this means that our signals are double that on each side of the zero frequency – 10 kHz each side. This results in a guard band of 10 kHz between channels if you are to have no interference from an adjacent repeater. It is possible at present to produce filters which will accept the 20 kHz wide FM signal, and still reject signals from beyond that, to the extent that even a strong repeater just 10 kHz outside of the desired passband is not heard. Fine – but now if we have the repeaters every 15 kHz this means that there will be an overlap of 5 kHz which is being transmitted within the receiver passband. If we changed to a 2.5 kHz deviation, we might be able to live with splinters. Simplex? It varies a lot. In hilly country it is almost nonexistent – in areas served by sufficient repeaters it is scant – but in flatland, away from the major urban areas, there is still a good deal of simplex – possibly the 40% you mentioned. I too oppose regression and chaos – and consensus is the answer – but we are getting away from consensus now and we need an exchange of information to get us back together, so please don't try to stop communication, even if you happen to disagree with some of the arguments... wayne.

... W2NSD/1 continued from p. 124.

company to settle for about one half of the cost of replacing the stolen stuff, even though the amount of the insurance far exceeded the claim.

It took several months to send for copies of the receipts for everything to substantiate that it had been purchased and for how much. The company tried to get out of the deal entirely by pointing to a fine print paragraph saying that the insuree had to be at least 80% insured, or else zilch. This required a complete inventory of all possessions and papers showing their value – to prove that the home was not under or over insured.

And so it went.

It may be a pain to sit down and read the fine print, but if you don't want to face years of weaseling, you'd better get out the magnifying glass. It can be most frustrating to find that you have been giving your premiums to the insurance company and have had no protection.

Many amateurs would like to know the least expensive way of covering their ham gear – at home – in the car. Perhaps one of our more knowledgeable readers in the insurance business can pass along this information. I think we'd like to know about being protected against theft, floods, storms, and such.

A sudden windstorm can come along and whomp down your tower, demolishing the tower, beam, rotator, and perhaps pulling the coax enough to ruin the rig too, running the bill up to perhaps $1000.

That puts me in mind of the time that a ham magazine editor, who shall remain nameless so I won't get sued, was out visiting a girl friend and his mobile rig was stolen. He didn't dare make a fuss because he was afraid that his wife would find out where he had been.

73 FEB COVER CONTINUED

I see where Time Magazine got into a hassle with a "sexy" cover and 350 of their 4 million plus subscribers cancelled in indignation. The newsstand sales for that issue increased by 54,000 copies. Hmmmm.

Strays

Beware that circuit in the March issue of *QST* wherein the voltage on the phone line is used to hold in a relay. The phone companies are NOT going to like you doing this. They are not going to like it a whole lot.

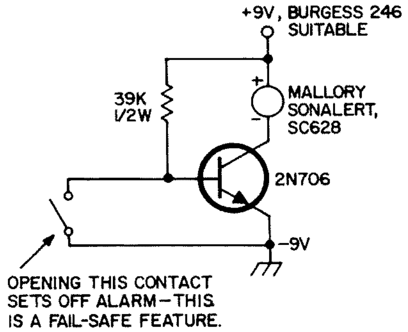
Beware too the almost wholly misleading article in the January *QST* wherein there is a supposed explanation of how to calculate the antenna height above average terrain. The author, WA1NXG, could hardly be more misleading. Do NOT use the system in the article of getting FM broadcast station data as the FCC has specifically refused to accept this data. Instead, follow the ultra-simple instructions in the docket (see page 112, November 1972 issue of *73*). Congratulations of some sort would seem to be due ARRL for not only publishing a totally misleading article, but then following it up with a subsequent award to NXG for the bum dope.

WAYNE

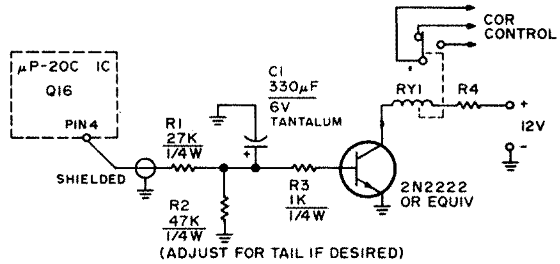
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

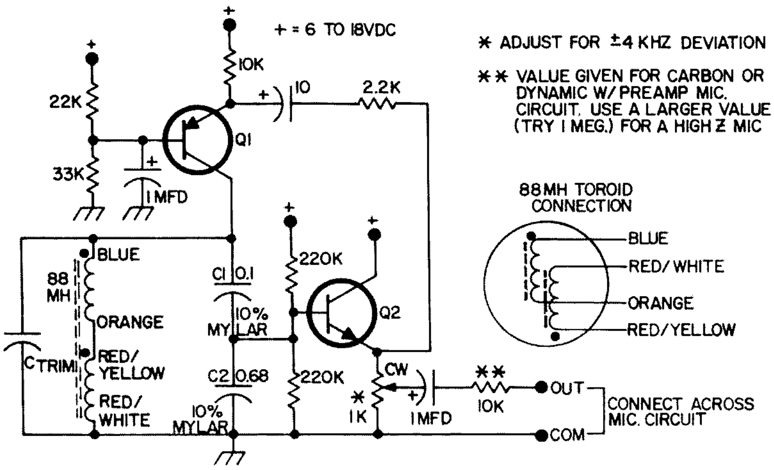
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



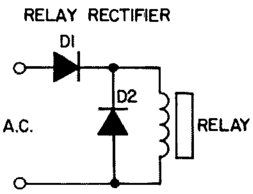
This is a circuit of a loud, low current burglar alarm. Since it operates from a small 9V battery it can be tucked away in a corner and virtually forgotten. Thanks to WB2BDF.



Schematic of a COR circuit for the TR22. R4 must be adjusted to keep the collector current of the transistor less than 750 mA. The value is dependent on the relay resistance. The R2/C1 combination controls tail time. The values shown will not respond to quick button pushers also. Thanks to W1WJR.

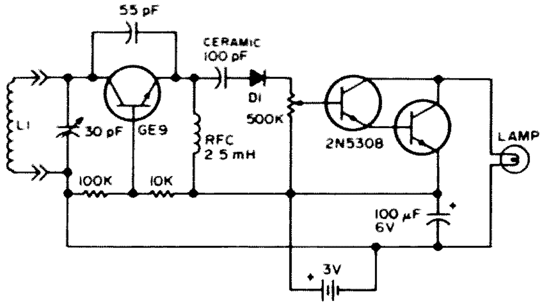


1800 Hz command oscillator for FM. Q1 — any PNP small signal transistor having a Vce rating of 1½ or more times the supply voltage. Some suggestions: 2N404, 2N1303 series, 2N2904 series, 2N3638, 2N6516 series, or 2N6533 series. Q2 — Any NPN small signal transistor having a minimum beta of 100 and a Vco of at least the supply voltage. Some suggestions: 2N1308, 2N2712, 14, 16, 2N2916, 18, 20, 2N3565, 2N3569, 2N6513, 14, 15, 20, or 21. Ctrim — 0.0062 μF was used in the first unit. If the mylar capacitors and the toroid are ± values, f1 = 1817 Hz. If CI is 10% low, fz = 1897 Hz. If C1 is 10% high, f1 = 1741 Hz. To find a value for Ctrim, measure the frequency (f1) without Ctrim. If it is higher than 1800 Hz (fo) calculate Ctrim. Ctrim = $0.1[(f1/fo)^2-1]$ =F. Thanks to WA0IKY.



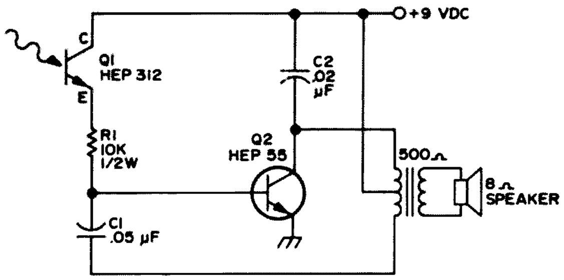
By the use of the circuit shown, it is possible to power a direct current relay from an alternating current source, with NO relay hum or chatter. D1 rectifies the ac in a normal half wave configuration, while D2 will slow down the collapse of the relay coil magnetic field to a point where the relay armature does not start to drop out before the next half wave of current is applied. Thanks to WA6JMM.

AND EVEN MORE, MORE, MORE, CIRCUITS, CIRCUITS, CIRCUITS...

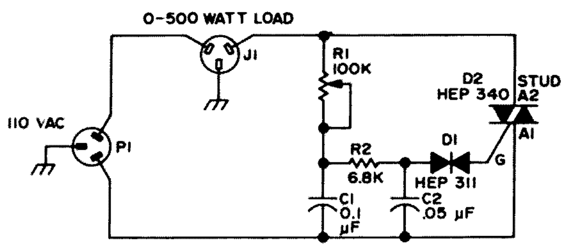


A simple "grid dip" meter that uses a bulb as a resonance indicator. Using the GE9 transistor will enable the unit to oscillate up to 12 MHz. The indicator lamp should be a No. 48 or 49 bulb. L1 should be wound to cover your desired frequency ranges.

VE3ECU.

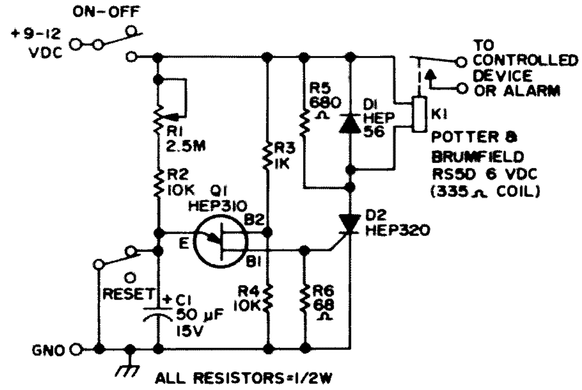


Light triggered tone oscillator that can find numerous applications as a burglar alarm, fire alarm or even to let you know that the sun has come up and it's time to turn off the rig and go to work. Courtesy Motorola Construction Projects HMA 37.

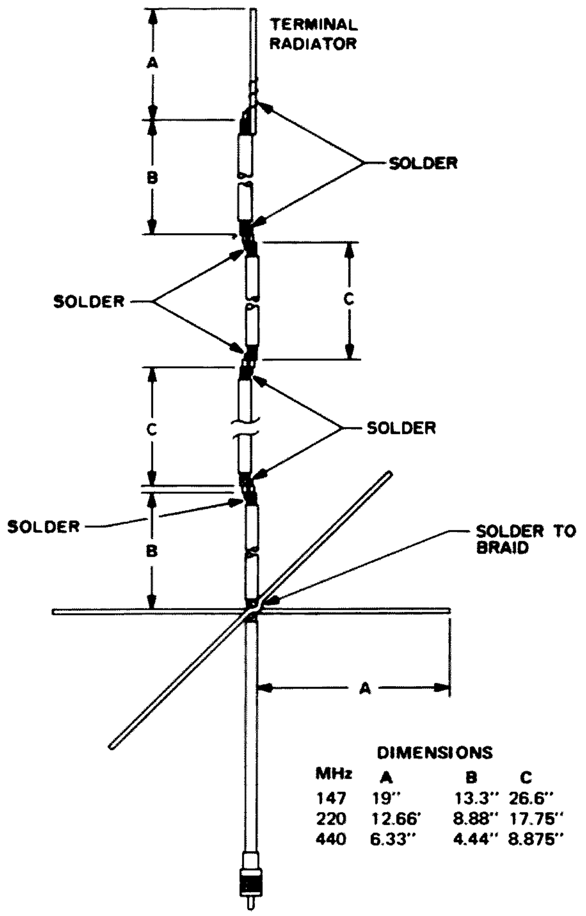


ALL FIXED RESISTORS = 1/2W
ALL CAPACITORS = 200V PAPER

Light dimmer/motor speed control. This circuit is able to control the voltage on loads up to 500 watts. Courtesy of Motorola Construction Projects HMA 37.



An electronic timer that can be set from 2 seconds to several minutes. This can easily be incorporated into a repeater's control system or even (Heavens!) the XYL's kitchen. Courtesy Motorola Construction Projects HMA 37.

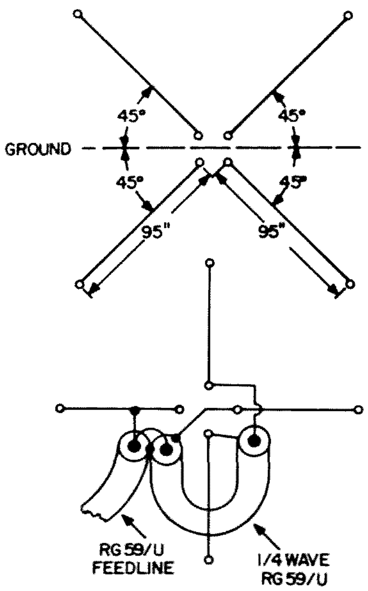


DIMENSIONS

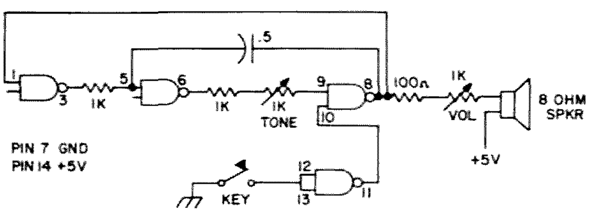
MHz	A	B	C
147	19"	13.3"	26.6"
220	12.66'	8.88"	17.75"
440	6.33"	4.44"	8.875"

Omnidirectional gain antenna for FM home or repeater use. The sections are constructed of measured lengths of RG-8 coax and are connected at the junction points by soldering the center conductor of one to the braid of the other and vice versa. The terminal radiator and radials can be lengths of stiff brass rod. A total of 9 "C" sections will give about 5.8 dB gain over a dipole.

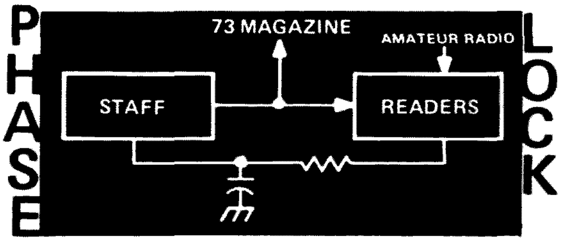
MORE CIRCUITS...



10 meter omnidirectional antenna for OSCAR reception. Mount each dipole antenna at right angles to the other and slant the halves down toward the ground at a 45° angle. Feed one dipole with RG59 coax, the center conductor goes to one half of the dipole and the braid goes to the other half of the dipole. Connect a ¼λ length of RG59/U to the first dipole connections and connect the other end to the 2nd dipole, i.e., braid to one element and the center conductor to the other. Thanks to W2EIF.



An inexpensive code oscillator circuit which requires one SN7400 quad nand gate and has tone and volume controls.
If the value of the .5 μF capacitor is increased, the frequency range of the oscillator will be lowered. The tone output is not the purest dc note, since a square wave is output directly to the speaker. However, it is quite satisfatory for code copy. The SN7400 requires a 5V dc regulated supply. A suitable supply can be built using a bridge rectifier circuit and a LM309K voltage regulator. Thanks to WA3SKE.



In this issue, do you think there is a need for more

	Yes	No
Simple construction projects	☐	☐
Complex construction projects	☐	☐
General interest articles	☐	☐
Humor articles	☐	☐
Specialized columns	☐	☐
Operating news	☐	☐
Other		

Which do you consider
the best articles?

Do you like the idea of specialized issues, as the Mobile, Antenna, FM issues, etc.?

What areas of amateur radio would you like to see emphasized in future issues?

Do you have any comments concerning the layout and style of the magazine?

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newsstand ☐

Please attach separate sheet for comments on our recent covers . . .

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J. H. Nelson

Good (Open), Fair (☐), Poor (O)

April 1973

SUN	MON	TUES	WED	THUR	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	$\boxed{16}$	$\boxed{17}$	$\boxed{18}$	19	20	$\boxed{21}$
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29	$\boxed{30}$					

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	14	7	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14A	14	14	7	7	7	14	21	21	21	21	21
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HAWAII	14	14	7B	7	7	7	7	7B	14	14	14	14
INDIA	7	7B	7B	7B	7B	7B	7A	14	14	14	7A	7B
JAPAN	14	7A	7B	7B	7B	7	7	7	7	7	7B	14
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ALASKA	14	14	7A	7	7	7	7	7	7	7A	14	14
ARGENTINA	14A	14	14	7	7	7	14	14A	21	21	21	21
AUSTRALIA	21	21	14	7B	7B	7	7	7A	7B	7B	14	14
CANAL ZONE	21	14	7A	7	7	7	14	14	14	21	21	21
ENGLAND	7B	7	7	7	7	7	7	7B	14	14	14	7A
HAWAII	14A	14	14	7B	7	7	7	7	14	14	14A	14A
INDIA	14	7A	7B	7B	7B	7B	7B	7B	7	7	7	7
JAPAN	14	14	7A	7B	7B	7	7	7	7	7	14	14
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SOUTH AFRICA	14	7	7	7	7B	7B	14	14	14	14A	14A	14
U. S. S. R.	7	7	7	7	7	7B	7B	7A	14	14	7B	7B

WESTERN UNITED STATES TO:

ALASKA	7A	14	7A	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14A	14	14	7B	7	7	7B	14	21	21	21	21
AUSTRALIA	21	21A	21	14	14	14	7	7	7B	7B	14	21
CANAL ZONE	21	14	7A	7	7	7	7	14	14	14	21	21
ENGLAND	7B	7	7	7	7	7	7	7B	7B	14	14	14B
HAWAII	21	21	21	14	14	7A	7	7	14	14	21	21
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PUERTO RICO	14A	14	7	7	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7	7	7B	7B	7B	7B	14	14	14	14
U. S. S. R.	7	7	7	7	7	7B	7B	7B	7A	7A	7B	7B
EAST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 magazine

for radio amateurs

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May 1973
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73 magazine for radio amateurs #152 MAY 1973

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Blows horn or siren.
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Keep 'em coming.

Cover:
The new 220 rigs pictured on this month's cover are, from left to right, the Tempo CL220, Clegg FM-21, Gladding 220 and the Drake ML-220. Below is the first 220 repeater, manufactured by Standard Communications.

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $7 for one year in North America and U.S. Zip Code areas overseas, $8 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A. Entire contents copyright 1973 by 73 Inc., Peterborough NH 03458. Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 221 Rock Hill Rd., Bala Cynwyd PA 19904. *The nude cover is still in the works — so eat your heart out, if you are that kind of a debased person — or live one more month in fear if you are a gay libber or the mere sight of a girl is disgusting to you, as some readers have admitted. This month's cover emphasizes the progress that is being made in 220 gear — with four of the 220 rigs and the first 220 repeater. More, much more, is coming — so think 220. FCC action on the possible CB occupancy of the low end of our 220 band is imminent — will it be delaying tactics or will it be the dreaded docket?*

Amateur Radio

MAY MCMLXXIII | Monthly Ham

TVI BILL

We've got a TVI Bill in the 93rd Congress, reintroduced by Congressman Teague of California. Its number in the current session is HR 3516. Except for the number, it is identical to HR 16916 (92nd Congress). As was the case last year, the Bill was referred to the House Interstate and Foreign Commerce Committee.

Now we have to go to work. We have to convince the Chairman of this committee to hold a hearing. But this will take letters . . . and lots of them. Letters from clubs, individuals, amateurs and non-amateurs alike; we have to flood the Chairman's desk with letters of support. Send your letters and petitions to your Congressman as well as to:The Honorable Harley O. Staggers, Chairman, House Interstate and Foreign Commerce Committee, 2366 Rayburn Building, Washington, D.C. 10515 and to The Honorable Torbert H. MacDonald, Communications and Power Sub-Committee, Room 215, Rayburn Building, Washington, D.C. 20515.

H.R. 3516
A BILL

To amend the Communications Act of 1934 to require that radio and television receivers meet certain technical standards for filtering out interference.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 303(s) of the Communications Act of 1934 is amended by inserting "(1)" after "(s)" and by adding at the end thereof the following:

"(2) Have authority to require that apparatus designed to receive broadcasts comply with standards of the Commission under this paragraph (2), when such apparatus is shipped in interstate commerce, or is imported from any foreign country into the United States, for sale or resale to the public. Standards under this paragraph shall be prescribed by rule for the purpose of requiring the filtering out of interference. Such standards shall include a requirement that all interference from any amateur station, and any citizens radio service station, operating on its assigned frequency, be filtered out."

TWO METER TUNE-UP CLINIC

The Naval Research Laboratory Amateur Radio Club, W3NKF, will sponsor a 2 meter tune-up clinic on Saturday morning, May 19, 1973 from 9:00 a.m. to 12:00 noon. All amateur radio operators are cordially invited to bring in their rigs for calibration using the latest available test equipment. Club personnel will provide assistance with transmitter checks and adjustments for frequency, deviation and power output. Autopatch frequencies will also be checked. Facilities will be available for testing either indoors or directly from the mobile so that removal of semi-permanently mounted installations will not be necessary. There will be no charge for this service.

Also, many NRL scientific displays of general interest to amateurs will be on exhibit including displays such as SSTV, color television, moonbounce and automatic Morse conversion.

The event will be held in Bldg. 22 of the Naval Research Laboratory located in S.E. Washington, D.C. just off Route 295. There will be a talk-in on 146.94 MHz.

HAM SCHOLARSHIPS

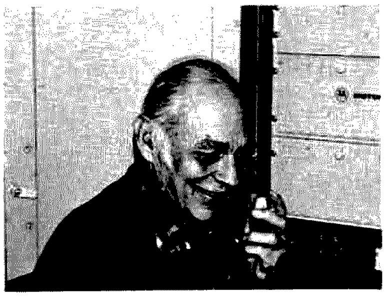
The Foundation for Amateur Radio, Inc., a non-profit organization with its headquarters in Washington, D.C., announces its intent to award three scholarships for the academic year 1973–74. All amateurs, wherever resident in the U.S. and holding an FCC license of at least General class, can compete for one or more of the awards.

The John W. Gore Scholarship pays $500. Applicants must intend to pursue a career in electronics or a related science and have completed at least one year in an accredited college or university.

The Richard G. Chichester Scholarship pays $250. Applicants must be a member of the ARRL and be sponsored by an ARRL-affiliated club. There is no restriction on the course of study, but applicants must be enrolled in or have been accepted by an accredited university, college or technical school.

The FAR Technical Scholarship pays $200. Applicants must have been accepted or enrolled in an accredited technical school.

Application forms can be requested from the Chairman, Scholarship Committee, 8101 Hampden Lane, Bethesda, Maryland 20014. Requests must be postmarked prior to June 1, 1973.



The largest amateur radio club in the east with over 400 members is the Northern Virginia FM Association, Inc. (NVFMA). The repeater is located near Washington, D.C. in Tysons Corners, VA on 146.31–91. From left to right in the first photograph are the officers: Bud K4ASU, treasurer; Don WB4QAX, president emeritus; Charlie W4YEB, director; John K4GGY, president; Bob W4GPD, director; Thom K4LHB, vice president. At the right is newly elected director Walt W3PWB.

LANCASTER HAMFEST

Hundreds attended the first winter hamfest in Lancaster County PA on Feb. 11th. It was sponsored by SERCOM of Lancaster County who operates the 01–61 repeater for the community and the local CD RACES unit. Highlights were an amateur TV demonstration and a two meter FM information session also attracted interest. Amateurs from as far away as New York State and Washington, D.C. made their way to the Naval Reserve Center in Lancaster.

Amateur TV demonstration by Ron Cohen K3ZKO of Philadelphia PA and George Gadbois W3FEY and Allen McQuate K3HOC, both of Lancaster, and employed at RCA. They supplied one of RCA's newest TV camera systems for the demonstration.

NORTHERN CANADA TO ADD TWENTY AMATEUR STATIONS

(CARF News Service)

Government employees being posted to isolated stations will soon be able to keep in touch with things "back home" via amateur radio stations now being supplied at some twenty locations in various provinces and the Territories.

DOC will issue amateur calls, with an official of the Ministry of Transport in Ottawa, Frank Lay, VE3ZN, as licensee. A series of 3-letter suffixes will be available in order to readily identify these stations to other amateurs. The suffix block "MTA" to "MTL" will be assigned, with the usual prefix "VE," plus the district digit. The stations will be operated only by holders of amateur tickets.

There are already a number of isolated post amateur stations in the Northwest Territories; VE8ML at Alert; VE8MB, Resolute; VE8MD at Isaachsen, VE8MC at Mould Bay and VE8MA at Eureka are at far north weather stations under the Department of the Environment. There are two Canadian Coast Guard vessels, VE0MC and VE0MZ. These will be joined by the twenty additional stations for the following posts: Battle Harbour and Sable Island in the MOT Atlantic Region; Inoucdjouac, Lake Eon, Nitchequon, Resolution Island and Poste-de-la-Baleine in the Quebec Region; Baker Lake, Chesterfield Inlet, Coral Harbour, Ennadai Lake in the Central Region; Sachs Harbour, Fort Good Hope, Tuktoyaktuk, Wrigley, Coppermine and Cambridge Bay in the Western Region; Bull Harbour, Ethelda Bay and Spring Island in the Pacific Region.

LEAD POISONING AVERTED

From the Knoxville News-Sentinel

A Knoxville ham radio operator recently accidentally heard an emergency call for help from an Argentine hospital – triggering a series of events resulting in a 6-year-old girl's life being saved through international Good Samaritanism.

Harry Kroll was trying to contact a Venezuelan missionary when he heard an Argentine official pleading for help from anyone who could provide an antidote for lead poisoning.

Mr. Kroll took notes about the emergency plea and called University Hospital's emergency department here. The hospital, in turn, contacted Mt. Sinai Hospital in Miami and the hospital there managed to get the antidote on a plane to Argentina.

HAM OPERATOR SETS WHEELS IN MOTION TO AID HEMOPHILIAC

From the L.A. Times, 3/5/73

A young man was bleeding to death on a hospital bed in Guatemala, and doctors were unable to staunch the flow completely.

German Daniel Corso, 20, a hemophiliac, suffered an injured leg in a traffic accident in Gautemala City. Doctors were forced to amputate the leg. They gave him plasma, and hoped, but Corso continued to lose blood steadily.

As the young man lay dying on March 3rd, ham operator Harold Walker of Canoga Park was tuning around on his radio. He was hoping to make contact with Australia, when he stopped to listen to the excited voice of a woman with a Spanish accent.

The woman, Anna Maldonado, of Guatemala City, was telling an Arcadia ham, Peter Grillo, how a hemophiliac was dying and no medicine was available to stop the bleeding.

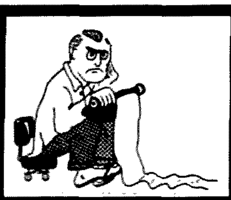
Grillo and another local ham, John Alexander of Palos Verdes Estates, were wondering how to find a doctor who knew where the medicine was available. Walker broke into the transmissions.

"I know a doctor," Walker told them. "I'll try to get him."

It was just after midnight Sunday morning when Dr. Don Michaelson got to Walker's home and on the radio. After talking with Mrs. Maldonado, he knew young Corso needed a medicine called Proplex, which came from a Los Angeles laboratory.

A plane was ordered from Travis AFB and much red tape was encountered, and cut, that involved getting the C-130 across Mexico into Guatemala on such short notice.

The next evening they got the word: The C-130 had delivered the Proplex to Guatemala City and the medicine was being given to young Corso. Doctors said he would recover.



NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

ARRL IN BATTLE

While every effort is being made to keep the fight as secret as possible from the U.S. amateurs, the fact is that there is a power battle going on in Canada between the ARRL and the Canadian Amateur Radio Federation (CARF).

The League has successfully managed to sidetrack all past efforts to organize the amateurs of Canada – and they may be able to do it again. It all depends on how well the CARF is supported by the Canadians.

The issue at stake is the expansion of the Canadian phone bands in retaliation to the recent expansion of the U.S. phone bands. The ARRL is against it – and CARF is furious. They are angry enough to have sparked the Canadian Department of Communications into agreeing to poll all Canadian amateurs to find out whether the DOC should listen to the ARRL or CARF.

It may be a bit premature for CARF to bring on a showdown. They have just now started a monthly publication, *The Canadian Amateur*, and they might have done better to wait a year or so until they had built up a larger following. Amateurs interested in subscribing to TCA can do so for $4 per year. The address is Box 356, Kingston, Ontario.

Since the need for separate Canadian phone bands has dwindled with the shift to sideband, the CARF may have seized upon a weak issue for the test of strength. Until the day comes when there are a significant number of Extra Class U.S. amateurs – a day that is not yet even within estimation – the U.S. Extra bands are empty enough to provide all of the isolation that Canadian amateurs might want. The concept of there being a U.S. phone band and a DX phone band began to fade away with the shift to sideband. In the old AM days, the U.S. phone band was a mess and foreign amateurs stayed out of it most of the time. Today the U.S. phone band is used world wide and little other than Spanish contacts seeping up from South America is heard in the DX phone band. And other than an occasional DXpedition, you hardly ever hear a contact being made between the U.S. phone band and the DX band.

When there were large numbers of low powered VE ops using AM, there was a definite advantage to having a small separate preserve. Today, when sideband has wiped out that type of operation almost completely, there is little need for such exclusiveness.

Any DXpedition operator will tell you that it is exceedingly difficult to make contacts outside of the U.S. phone bands, even with DX stations. Moving below 14,200 brings a halt to the rush of contacts.

Well, it certainly is time for the VE amateurs to start deciding their own destiny and to get the ARRL out of their hair. It should be a matter of national pride, if nothing else. That should be of more importance than any possible interference from the mere handful of Extra Class licensees who are sharing the Canadian phone bands – only about 4% of the U.S. amateurs have the Extra.

WR1AAB ISSUED!

The first repeater license issued went to WR9AAA in Joliet, who submitted an exhaustively thorough 75-page application. Lest amateurs think this was to be the best way to get a license, the second application accepted was for the old WA2SUR repeater in Manhattan. George and I made a trip to Washington in early December to find out the best way to submit an application and get it accepted. On the basis of this we held a symposium in New York on December 7th and spilled the beans for any repeater groups interested.

For some reason most repeater clubs seemed more interested in doggedly pursuing their ideas on filling out applications rather than trying to profit from our Washington visit. George did pay attention though, and in a few days he was ready with a very simple application. Not wanting to leave anything to chance he personally took it to the FCC in Washington and got them to check it out on the spot.

Continued on page 110 . . . . . .

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	38.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325.

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

This month I would like to begin with a review of some "Getting Started in Slow Scan" information for our many newcomers. You can get started with only a monitor and tape recorder. (And some tapes with your call, picture, etc., possibly recorded by the same "source" as your monitor.) Later a camera or Flying Spot Scanner may be added so you can "go live" and make up new programs for changing pace. Cassette recorders (the

better quality ones) are handy, since separate "carts" for each program can be made up, end labeled and wall racked for instant use. If this same program is recorded on each side (direction) the cart will be rewinding while playing. Cassette speed (1 7/8 i p s) is slightly slow for absolute perfect sync stability, so a small amount of "jiggle" on vertical lines may be apparent on reproduced pictures. This can be reduced somewhat by using only top quality cartridges. Should you personally find this minute "jiggle" objectionable, a reel to reel recorder (preferably running at 7 1/2 or 15 i p s) might be the better choice for perfectly reproduced pictures. I would suggest separate reels for each "program," marked at their exact beginning and with leader tape. (You can write on paper leader with a ball-point pen.) A small label on the reel could show content. It would also be advisable to record (and play back) with the same size reels on each side, (feed and take-up) and only in the tape's middle portion for perfect reproductions.

Produced tape programs might include pictures of yourself, XYL, rig, city, and plenty of ID's. Some ID's could be catchy and snazzy; others (maybe for DX) would be better with white letters on a black background. Your call 3 or 4 times horizontally per frame would be quite effective also. When operating with these newly acquired tapes, try to describe them briefly before transmitting, so the other fellows will have some idea of what you are sending. Then usually 3 or 4 frames are sufficient for good copy without getting dull.

Although Slow Scan is one of the most fascinating modes of communication today, often we find ourselves falling into a "rut" as to program content. (Are we spending more time developing it than enjoying it?) Actually, there's no limit to the possibilities obtainable with just a camera and some time. A pet hamster would be good for some shots with the close-up lens (imagine *that* face filling your screen!) and what better way is there to pass along schematics on your pet projects. Understood, larger diagrams might require multiple frames, but these can be redrawn off the monitor screen after reception to "reasssemble" the full circuit. (What . . . you've never built something from a schematic received over the air?) That homebrew monitor you recently finished would be a natural for an SSTV program. Why not make up a tape on it, with different angular views, close-up details, and under chassis shots. In fact, practically everything of interest to visitors in your shack would be a prime SSTV "subject."

Commercial Fast Scan TV stations have recently begun to use Digital Character Generators interfaced with teletypewriters for information print out on TV screens. Possibly you have seen this during newscasts or sports events, where weather conditions appear across the screen either mixed with the "weather girl" or on a black background. Naturally, items like this are applicable to Slow Scan, and experimentation is presently being conducted on interfacing teletypewriters to Slow Scan generators. Then you can just type out those ID's, QSLs, etc. from the old "mill." Watch for more info on this to appear by late '73 (and in *73*!).

I'm sure most of you are familiar with Professor Fanti I1LCF, who writes the SSTV column for *CQ Elettronica* of Italy, the sponsor of the World Wide SSTV contest. Although he is still active in SSTV, he is also developing facsimile, plus writing a book on FAX. Franco would like to exchange ideas with those of you also working in FAX. Here's your chance to get in on weather satellite copy or develop FAX/SSTV converters. You might drop him a letter if you miss him on 21.300 kHz Thursdays at 1300 GMT, when he meets stateside schedules.

And, finally, a recently heard comment on 20 meters after an "operator mugshot" transmission on Slow Scan: "Mommy . . . buy me a face like that for Halloween!" Gad!

73, Dave, K4TWJ

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50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

KØTVD comments on mild Aurora worked February 22nd and 23rd. Chuck managed to work Ron KØALL of Fargo ND on CW and SSB on the 22nd and heard him again the following evening. Chuck says he is about half finished with a pair or 4-400A's and hopes to have them on the air in time for the June contest.

WA1EXN says Maine had an excellent Aurora on February 21st; he traded 20/9 reports with WB4YAB in Kentucky. The 22nd brought a weak repeat, CW quality only, with only 1's and 2's being heard. The 23rd the Aurora was again excellent but there was little activity. Art also mentions a marathon one-minute meteor burst at 1518Z on the 19th of February during which he exchanged S9 plus reports with W8YUS and W3BWU. A total of 75 DX contacts were made during the first 60 days of the year.

Late word has been received to the effect that the 1973 West Coast VHF/UHF Conference will be held May 5th at the Pen and Quill Hotel, 3501 North Sepulveda Blvd, Manhattan Beach CA. Anyone wishing information should contact the conference chairman, WA6HXM, Box 2473, Palo Verdes Peninsula CA 90274.

The Central States VHF Society conference will be held August 17, 18 and 19 at the Mariott Inn, Bloomington MN. Further information is available from John C. Fox, WØLER, 321 109th Lane NW, Minneapolis 55433. The program this year includes talks on Es by W2BOC and WA5HNK, VHF-UHF solid state amplifiers by Roy Hejhall of Motorola and meteor scatter by W4LTU.

During the past month I have had some very interesting correspondence from ZL1Q1. Paul says he is one of about 12 ZL's active on 6 meters. He runs a homebrew transverter with 40 watts out from a single 6146. The receiving converter is solid state (FET's). The antenna is a four element Yagi at 40', the basic rig is a Yaesu FT-200. The New Zealand 6 meter band is 51-53 MHz, while in VK land it is 52-54 MHz. Paul's best DX to date is a VK5 at 2300 miles. As in many countries, the TV channels usurp portions of the 6 meter band (as we know it). This is not all bad, as Paul points out. New Zealand channel 1 sound is on 50.75 and has been heard in the KH6 and KL7 areas. This transmitter runs 100 KW ERP and makes an excellent beacon. Paul mentions too the jamming of New Zealand (40 MHz) police radio by the Chicago's Finest radio system. Paul normally listens at 52 MHz but does tune the entire ZL portion of the band. Normal operating times are 2100Z Sundays and about 1200Z several days during the week.

One can't help but wonder if the forming of Collins Radio Co. of Japan Ltd. in conjunction with Kyokuto Boeki Kaisha Ltd. for the purpose of producing maritime and amateur gear will produce any equipment for 6 meters. Collins has been out of the VHF field since the 62S1 was dropped several years back.

WAØABI

DRBRMYU YJTRR HOGY DINDVTOQYOPMD EOAA NR TRZRZNRTRF SAA URST APMH. FPY HONDPM

DX FOOTNOTES

Those of you who have worked your 73 countries in the first 73 days of 1973 should send in your list of the 73 countries so I can issue you the 73-73-73 award (remember the year 1973 is 73 magazine year). Maybe we should try to get President Nixon to make some sort of a "declaration" ! I bet if Goldwater was in this would "maybe" be done, because he understands such things.

The WTW is coming right along again and the applications are coming in very good. I still think this is the best DX award there is, because it can keep you busy on the various bands and modes. The big trouble with the ARRL 5BDXCC is when you make the 5BDXCC you have worked yourself out of a job ! With our WTW, you can keep on going. You will always have something to do.

We are still looking for DX Clubs to have as verification points in our WTW. We would like to have one in each USA call district, one for Canada and one in each of the foreign countries. A good way for these clubs to get a little publicity because we will list the various confirmation clubs in this magazine. I would not think the work load would ever become heavy with each call area having its own check-point. How about it, some of you "wide awake" DX Clubs ?

You fellows who operate on the low bands, fighting all the summertime QRN should keep in mind that the fellows in the southern hemisphere are not having any summertime QRN, they are in their wintertime, so you might have some good contacts with them if your ears and nerves can stand the strain. Watch out for them and give them a chance to work you without a lot of QRN.

If any of you know of any upcoming DXpeditions or other events that someone has planned for about 3 months in advance I sure would appreciate you letting me know because I would like to let the DXers know what's in store for them so that they can arrange to be at home when the "event" takes place. You would be very much surprised to know how many DX'ers seem to "get sick" when they know of a new country that's about to come on or is already on the air. Bill Orr at Eimac once told me that I almost shut down the whole Eimac plant when I showed up at a "rare" or new country. (They must have a lot of DX'ers working out there at Eimac.)

The Old Sun Spot cycle is showing its stuff, and is on its way downhill. Sure hope most of you have worked the 10 meter band dry and are doing the same right now on 15 because, "it wont be long" before the DX will just be non-existant on these bands. In fact it looks like the 10 meter band has already "had it" as far as the real good DX coming thru is concerned and I would guess that 15 meters will be in the same shape in a few more years from now. Even the good old 20 meter band will be a little "shaky" at times. If ALL the those sun spots would disappear we DX'ers would be in real trouble as far as working DX the usual way is concerned wouldn't we ? Let's all of us hope the sun never loses all of its spots. They are what gives us all that dx and it seems as if there is no way to fight it. I guess we all would have to go to Moon-bounce or satellite stuff when and if this ever happens. I guess this would be a real deal if there were enough DX countries operating by these modes.

Shortly now we will have our WTW country list printed up, and it will be designed in such a way that it can be used for your application for any of the WTW plateaus (WTW-100, WTW-200, WTW-300, phone or CW etc.) When they are done I will be glad to send you a few of them if you send me about 6 cents in stamps for EACH set of forms you request. You will observe that the WTW list of countries have a few thats not on the ARRL DXCC country list. Without going into a lot of details as to why, let's just say this is the WTW list of countries - OUR LIST, AMEN !

For those of you who are serious DX'ers there are a number of weekly, and semi-monthly publications, most of them are single or two page items they are known as "bulletins" and one of them is a weekly magazine. That last one is published, printed and edited by me - W4BPD, it has from 16 to 24 pages each week and since the lead date for news in this magazine is only a few days, it is natural that the DX news is the news of events that are taking place at the time you are reading it. Some of the other bulletins are the Long Island DX Club bulletin, the West Coast DX bulletin, Geoff Watts' news sheet, and there are a number of DX Clubs that at times print (usually mimeograph) bulletins about various DX events that should interest the serious DX'er. In the "gud ole days", the only way you could find about DX was for you to be on the air when it "popped" or else you just put on your headphones, opened up your RF gain, put your head down on the operating table and very carefully scanned the band from one end to the other, and you kept on doing this hour after hour, listening for that very, very weak T3 signal, mixed up in QRM/N, hoping it would, maybe be AC4YN, FN8D, CR1Ø AA, C8YR, J8CA, PK6XX, VQ3PBD, FB8XX (I got all these JUST LIKE THAT !) because there was no such a thing as any DX magazine or DX bulletins to let you know what good DX was coming up. Hunting DX these days is about like hunting doves in a "baited field" ! It is impossible for a monthly magazine to dish out DX info of some DX event that will take place in a few days or a week or so in the future. We would like to receive any announcements of up-coming DXpeditions that are some months in the future so that we can give out the good news to the DX gangs across the country. Please remember us and it will speed things up considerably if you shoot the news directly here to me (drawer DX, Cordova, S.C. 29039).

I hope all of you got SY1MA who operated at Mount Athos, it's a new one and is now considered as a country by ARRL towards their DXCC (and also a new country for our WTW, too.) I would think others will be going there now since the ice has been broken. Maybe now someone can get the doors opened to The Royal Order of The Knights of Malta who has a small (one city block) enclave right smack in the city of Rome, Italy. There are a number of similiar set-ups in the world, and it would be a fine idea as far as I, myself, am concerned to count 'em all as new countries, the more the better ! There is an Italian province (?), actually inside Switzerland, it's called Compion d'Italia and it's located on Lake Lugano. I was there under the call of IC1IN and after all the trouble getting the necessary license etc. ARRL said it was not a new country and my Italian friend who was along with me had to have a Passport to get there ! I think we will put it in our WTW list of countries. Around the world you will find many "Neutral Zones" - the Kyber Pass is one I have in mind, I was there and would have put it on the air if ARRL could have said it would count for a new country. Quite a few will be found around some of the Arab countries where they allow herds to graze when the grass happens to sprout up. Either country will allow their natives to go there whenever they want to without any passport, custom inspections etc. I would think since they are true "neutral zones" they should be called new countries.

C U ON THE LOW END

de, Gus W4BPD

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Something that must be remembered by those who read this column is that there is a two month delay between me writing it and your reading it. In a field as quickly changing as OSCAR 6 it is nearly impossible to have last minute news. However, since this can be obtained from the nets, the purpose of this column is to advise and attempt to interest more amateurs in participating actively in OSCAR 6. Since some amateurs are still just beginning, it provides a backlog of useful information.

Many amateurs are running some fine scores in the various contests through OSCAR 6. A full list will appear next issue with a rundown of hams who have won the ARRL OSCAR 6 "1000" award, plus hams who have records in counties contacted, etc.

OSCAR 6 EQUATOR CROSSINGS

Period = 114.9946 minutes per orbit. Longitude increment = 28.7484 degrees per orbit.

Orbit	Date	Time (GMT)	Longitude of Equator Crossing °W
2396	Apr 25	0036	56.2
2409	Apr 26	0131	70.0
2421	Apr 27	0031	55.0
2434	Apr 28	0125	68.7
2446	Apr 29	0025	53.7
2459	Apr 30	0120	67.4
2471	May 1	0020	52.4
2484	May 2	0115	66.1
2496	May 3	0015	51.1
2509	May 4	0110	64.8
2521	May 5	0010	49.8
2534	May 6	0105	63.5
2546	May 7	0005	48.5
2559	May 8	0100	62.2
2572	May 9	0155	75.9
2584	May 10	0055	60.9
2597	May 11	0160	74.7
2609	May 12	0049	59.6
2622	May 13	0144	73.4
2634	May 14	0044	58.3
2647	May 15	0139	72.1
2659	May 16	0039	57.0
2672	May 17	0134	70.8
2684	May 18	0034	55.8
2697	May 19	0129	69.5
2709	May 20	0029	54.5
2722	May 21	0124	68.2
2734	May 22	0024	53.2
2747	May 23	0119	66.9
2759	May 24	0019	51.9
2772	May 25	0113	65.6
2784	May 26	0013	50.6
2797	May 27	0108	64.3
2809	May 28	0008	49.3
2822	May 29	0103	63.0
2834	May 30	0003	48.0
2847	May 31	0058	61.7

Once you have at least one solid contact through OSCAR 6 you are qualified to become a member of the Satellite Communications Club. Just send SASE along with date and time of contact and call sign of the station you worked to AMSAT, P.O. 27, Washington DC 20044. You will receive a nice certificate to hang on the wall of your shack.

Have you heard of, seen, or done anything notable or unusual with OSCAR 6, such as making contacts – using only a whip antenna or working through the satellite while riding on a bike? If so, please send the details to me. Also, if you have taken a lot of time and effort in setting up a nice station, send me a photo with you at the controls.

At this writing, the 435.1 MHz beacon is definitely out. There have been a lot of opinions as to the cause, but as of now nothing definite.

Has anyone observed any odd propagations connected with OSCAR 6? A few amateurs – unfortunately I don't have their calls – have observed what is possibly skip in various contacts. Anyone experiencing this or any other odd propagation please send date, time and call to me.

The Dayton Hamvention is promising to be one of the biggest and best this year. A whole list of programs is in the making. AMSAT will conduct a number of seminars that will prove to be interesting. A station is being set up at the Hamvention for working through the satellite, and a number of people will be there to help with any problems or compare notes. Take a day off and visit the Dayton Hamvention. See you there.

WB8LBP

TOUCHTONE FOLLIES

Can man ever take an invention seriously? To quell the insatiable desire to (subvert?) – find new uses for old things, someone started tapping out tunes on their Touchtone telephone. The practice has apparently turned into a rage and commonly heard tunes are being uncommonly heard everywhere.

While it is obvious that the FCC would frown on an amateur serenading his girl over the local repeater because of the regulations restricting the transmission of music, what's to stop a group from setting up the access code for their machine to sound like "Mary Had a Little Lamb" . . . or for the larger repeaters, "Strangers in the Night"?

Either way, we'll be printing a few of the more popular songs in these pages strictly for your own amusement.

MARY HAD A LITTLE LAMB

6 0 4 0 6 8 6
Mar-y had a lit-tle lamb
2 2 2 6 6 6
Lit-tle lamb, lit-tle lamb
6 0 4 0 6 6 6
Mar-y had a lit-tle lamb
6 8 8 6 8 4
Its fleece was white as snow

STRANGERS IN THE NIGHT

4 8 8 4 8
Stran-gers in the night
4 8 6 8 4
Ex-chang-ing glan-ces

AMERICA

5 5 6 1 5 9
My coun-try, 'tis of thee
0 0 8 0 8 4
Sweet land of lib-er-ty
8 4 2 4
Of thee I sing

novice

Schley Cox WN9LHO
219 Kilgore Avenue
Muncie IN 47305

At 0011 GMT the other night I called a WN8 in answer to his CQ. I didn't get a chance to give him his 479C signal report because he answered my call with a too-lengthy preamble and then sent "QRM 73 CUL" and then signed off the air. At 0015 I logged an end to my shortest contact on record outside the Novice Roundup.

I know that sometimes we get on the air and the dinner call suddenly comes 30 minutes early or the envelope starts to melt on the final amplifier tube, but I have a suspicion that sometimes the super-short contact is due to one or both operators having nothing to say.

Tradition has saved some new ops from mike fright by dictating that the RST, QTH and name be sent on the first transmission; the rig and antenna on the second; and finally heartwarming 73's and fervent CUL's on the third and last.

This is unfortunate unless there is a distinct need for brevity – e.g., contests, traffic or emergencies. There is a

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID—TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

lot to talk about even at 5 wpm. I like to learn something about the person I am talking with on the air — what he or she does for a living, how old he is, how many states he has worked, is he a buyer or builder, has he ever visited Indiana (or wherever I might be).

One of the important things I like to hear from other ops is how my signal sounds. I have heard a few Novices get into lengthy discussions about signal reports, and maybe how one person's signals are not quite chirpy but that there is a definite frequency change during key down.

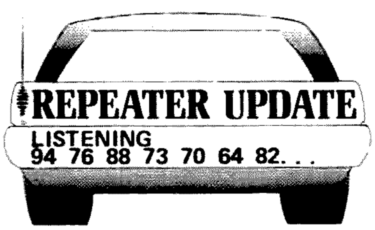
Some amateurs seem to be afraid to tell the other operator if they have a little chirp or click. There are some people on the air who either never work weak stations or they just can't bring themselves to give an honest 249 signal report.

Most Novice ops have to depend on signal reports from other hams for any idea how their transmitter or antenna is performing. Sending an inflated signal report in hopes of avoiding embarrassment or insuring receipt of a much-needed QSL card is a disservice to any operator.

If you feel like talking awhile, you may have to ask some questions of the other guy before you get the conversation going. But if you do get a rag chew going, remember to keep the transmission short to make sure you are being copied.

There is very little reason for hit and run contacts on the Novice bands. The ARRL suggests we refrain from talking about religion, politics or sex on the air. That leaves a pretty good selection of things we can and should be discussing.

WN9LHO



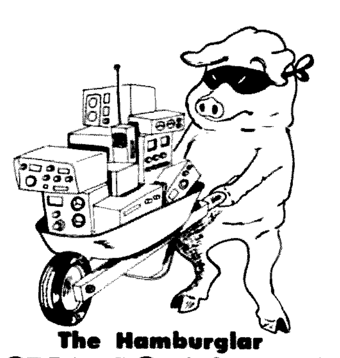
NEW LICENSE ARRIVED?

When your repeater receives its new WR call, the second thing that you should do (after changing the identifier) is fill out the above form and mail it to 73. This will enable us to keep our repeater listing current and accurate. It will also make sure that the FM world doesn't forget you . . . for the 73 Atlas is recognized as the one complete listing of repeaters for the entire world.

UPDATES NEEDED

If you know of a new repeater or of an established machine that has received its WR call, mail in the above form completed with as much information possible. We would prefer having duplicate — triplicate — even megaplicate information rather than none at all.

CA	WB6ZRR	Novato	Closed		146.40–147.51
GA	K4GCR	Albany			34–94
ID	W7CTX	Boise			28–88
MA	WR1AAA	Malden			31–91
	ex-W1BHD				
NH	WR1AAB	Peterborough			19–79
	ex-WA1KGO				
NY	WR2AAA	Manhattan			147.73–148.73
NY	WA2VNV	Stonybrook L.I.			16–76
NY		Flushing L.I.			147.09–146.69
PA	WA3KXE	Harrisburg			446.00–440.00
SC		Caesar's Head			04–64
TN	WB4KLO	Chattanooga			19–79
WI	WA9AOL	Milwaukee			146.25–146.85
WI	WA9AOL	Milwaukee			449.50–444.50
WI	WA9AOL	Milwaukee			1250.0–1220.0
WI	K9YFF	Racine			52.600–52.525
WI	WB9AES	Maukesha		PL	146.22–148.82
WI	W9WK	Milwaukee			146.07–146.67
		Milwaukee			448.75–443.75
CANADA					
ALBERTA					
	VE6CAM	Lethbridge			28–88
PRINCE EDWARD ISLAND					
	VE1ATN	Charlottetown			148.10–52.525
					52.525–147.00
				T	146.10–147.00



The Hamburglar STRIKES AGAIN!

SAUL A. COHEN

73 Magazine

Dear OM:

I am pleased to advise that my Swan Cygnet 270 # 313022 stolen 9/72 has been recovered and can be removed from your list, "Hamburglar Strikes Again".

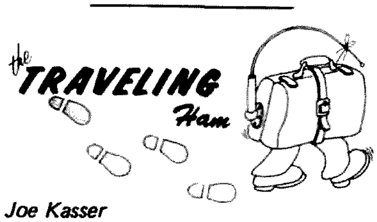
Thanks very much.

73

Saul A. Cohen
K4ACJ

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
Coll. 62S1 No. 10728	MSU ARC E. Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
~~Swan Cygnet 270, No. 313022~~	~~K4ACJ~~	~~9/72~~
Collins Mic, Mod.MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No. M-395430	W8HST	11/72
AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M, No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459 NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327885	WA6WOA	4/73



Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

The travelling ham usually carries a lot of valuable stuff in the car. How does he protect it? Car alarms are quite readily available and usually work by frightening off any would-be thief by the use of the car horn. For example, either the door or the rig is fixed with a microswitch that sounds the horn if anyone tries to tamper with the equipment. There are many such units available, but since any thief who knows his stuff is aware of the plentiful supply of such devices, some counter moves must have been developed (I do not have any first hand knowledge of any myself, since as far as I know none of my friends are in the car thievery business). One simple method that comes to mind is to open the hood and disconnect the wires to the horn. Very quick, simple and effective.

Now the travelling ham has a car full of electronic equipment. A VHF-FM unit for local communications, and an HF-SSB rig for talking back home. Why can't this stuff be put to use in an alarm?

The early FM gear was modified commercial equipment, usually trunk-mounted with a control head under the dash. Why can't a tape cassette player be connected to the FM rig such that if the car is stolen (driven off by someone other than the owner) the rig will transmit a recorded message repetitively. The rig could be put on 52, 94 or the local repeater channel and broadcast, "I am a blue Dodge demon, I am being stolen, my license plates are GJP 887 Michigan." The rig should of course be set up so that if there is a signal on freauency when tne meft alarm is activiated, it will wait until the frequency clears. That can be arranged by judicious use of the receiver squelch line. The broadcast should not be continuous but should be repeated at regular intervals in the order of two to three minutes. If no indicator light comes on in the car, the thief will *never* know wnat hit him!

That takes care of the bloke who is going to try to steal your car, but what about the one who just wants to help himself to your belongings? Well, any body getting into your car could cause the transmitter to start sending tone bleeps on an unused channel (by everyone else that is), you would hear them on the handytalky attached to your belt and come running, or talk back to the car by means of the same handytalky and scare off the intruder. You could even arrange for any sounds in the car to be transmitted to you so that you can monitor the progress of the intruder while you race back to the car.

Small low power modules to build such alarms are advertised regularly in 73 as transmitters and receivers but may easily be incorporated into active theft alarms.

Such devices could be incorporated into private repeaters located within the trunk of one's car. It is thus possible to have the high power rig in the car and talk through a low power hand-held unit to the car, out to a distant repeater or on a simplex channel. This can all be made quite legal in spite of the recent FCC repeater docket if use is made of model control techniques and frequencies and citizen band equipment and frequencies. There are a large number of frequencies available in the USA where any transmitter with an input power of less than 100 mW does not require any license whatsoever. Think about it. The serious ham engineer should be able to work something out.

...G3ZCZ/W3

Editor's Note: And it has *been worked out... see p. 19!*

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful — remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Earl L. Grove
891 Commonwealth Ave
Venice CA 90291
213-396-7315

Kenneth Hand
Montauk Highway
Bridgehampton, L.I., NY 11932
537-3882

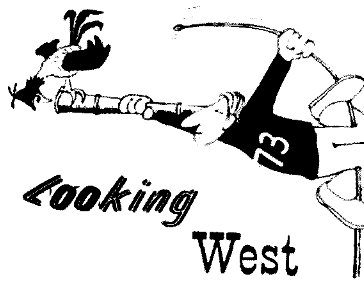
David Sundin
PO Box 225
Camden AR 71701

William Grandin
Box 127
Roulette PA 16746

David Ellithorpe
194 Forbes St. Ext.
Amsterdam NY 12010

Tom Mohr
1513 Traeger
Green Bay WI 54304
414-494-4434

Donald E. Morris
7022 Old Trail Rd.
Fort Wayne IN 46809
219-747-4607



Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

Well, as you all know by now, the earthquake Wayne prophesied at the end of my March column came to pass, but I am happy to report that Los Angeles is still where it is supposed to be. After going to the trouble of filing for a 6 land call, having to re-file for a KL7, somewhat boggles my mind! The only damage at this QTH was a box of open carpet tacks that fell off my desk and scattered all over the shag carpet in the shack. Ever try to recover a hundred or so of these tacks from that type of carpet? I still get one in the foot now and then. Aside from that, the quake itself felt like a train passing through my back yard. At my old home in Brooklyn we had the Sea Beach subway running open pit about 20 feet from our rear window, so I know that feeling quite well.

Now, back to amateur radio and what this column is all about. No new news out of Phoenix on the situation there.

Turning to the local happenings in and around Los Angeles, the big news is in the form of a brief report on the second meeting of the Southern California Repeater Association. In fact I should subtitle the following, "How to Report on a Meeting Without Being There." The secret lies in owning a good cassette tape recorder and having friends like Tony WB6MIE, Dave WA6CGR, Bob WA6JGW and Chris WB6HGW. They have become the official LW recording staff and did a job that would make pros in the business take note. After spending a good part of Sunday listening to the meeting in the comfort of my own shack, I can pretty well state that this is one of the best run amateur organizations anywhere. I have rarely heard or participated in a meeting that gives those in attendance as much a chance to actively participate, yet accomplished with complete order and decorum. No, S.C.R.A. has not yet solved all the problems we face here in Southern California, but it is my belief they have the ability to do so.

The meeting, held March 3 in Culver City, was hosted by the Pallisades Amateur Radio Club and emceed by Fred Deeg K6AEH. Though this was the second meeting of this organization, it was the first planned official meeting and was held to really get the group going. It should be noted that at their first meeting last September they made amateur history by coming up with and agreeing on a band plan for two meters in a matter of hours. This plan, now in use here, has not only proved itself quite workable with slight exception, but has shown that we as amateurs can work together for the common good of all involved. If you keep in mind that Southern California was for many years the nation's sore spot when it came to channel standardization, getting a viable system going in as short a time as they did is a real feather in their collective cap.

There was a discussion of a band plan for 220, and it was decided that no action would be taken at this time. Rather, the Technical Committee was instructed to come up with one that would suit the needs of the area before July 1st. Though I had hoped to hear something definite come out of the meeting concerning 220, after considering what was accomplished in such a short time on two meters, I have a feeling that when S.C.R.A. announces their 220 plan it's going to be something that may well help set a national standard for that band. Call it a premonition or what, I think this organization is going to make it. It is one of the few regional repeater organizations that is both owner and user oriented, and makes membership open to all. They believe in action rather than talk, and the results are evident.

A 34–94 Repeater in L.A.? There may be a bit of a storm brewing out here. For many years 146.94 has been the area simplex frequency. Unlike many other places where 94 is designated for simplex but not used, in L.A. there are several hundred FMers who use that channel daily.

There have been, I've been told, attempts made in the past to put a 34–94 repeater on the air in this area. All have met with failure. To the traveler, a repeater on that channel would be welcome, but is it a definite necessity? The tradition here is strong; 94 is simplex. However, I ask all parties to use proper judgment in resolving the matter. No repeater can hope to function if the majority is against it. I as a reporter stand neutral on the matter. I cannot print long letters due to space limitations, but if you want, I will try to present both sides of the question.

Transcontinental Repeater Link. In a short time I hope to be able to report the first linkup of a repeater here in L.A. with one on the East Coast. This has been your reporter's pet project and plans for it are under way. We hope to legally link (via telephone) for a few hours and give amateurs on both coasts a chance to meet and exchange ideas.

...WA2HVK/6

SOCIAL EVENTS and CONTESTS

FFVHF CONTEST

The Five Flags ARC VHF contest will take place on 0001 GMT 19 May '73 to 2400 GMT 20 May '73; operate any or all of the 48 hours authorized. Exchange RST, QSO number and section. Repeater contacts will count only once. Each contact will have the following – Points per band per QSO; 50 MHz = 1, 144 MHz = 2, 220 MHz - 3, 420 MHz = 4, all other bands above 420 MHz =5, crossband operation not permitted. Power Mult. 5W or less X 4, 30W or less X3, 320W or less X2 and 1000W or less X 1. Mode Mult. CW and SSB X 1, all others X 2. ARRL sections and new countries count 1 per band for mult. Total sections times total points for final score. Send log and summary sheets to WA3ODA/4, 1801 Border St., Lot 37, Pensacola FL 32505, postmarked NLT 1 June '73. Send SASE for contest results and/or award.

GEORGIA QSO PARTY

Starts 2000 GMT, Sat., May 5, 1973. Ends 0200 GMT, Monday, May 7, 1973. The twelfth annual Georgia QSO Party is sponsored by the Columbus Amateur Radio Club, Inc. There are no time nor power restrictions and contacts may be made once on phone and once on CW on each band with the same station. Each complete contact counts 2 points. Georgia stations multiply their total QSO points by number of different states and Canadian provinces worked. DX stations may be worked for QSO points but do not count as multipliers. Out-of-state stations will use the number of Georgia counties worked for their multiplier (a possible total of 159). Write to CARC, Inc., Attention: John T. Laney K4BA1, P.O. Box 421, Columbus GA 31902 for full information on the contest.

RCMP CENTENNIAL

The Royal Canadian Mounted Police will be operating an Amateur Radio Station at Ottawa, Ontario, to commemorate their 100th anniversary. This station will operate during the period commencing 23 May 1973 to 30 August 1973 from 1200 hours GMT to 0400 hours GMT daily. Operation will be on 80 through 2 meters, using CW, SSB and FM. A special call sign, VE3RCMP, has been approved by the Department of Communications for this purpose. A commemorative QSL card will be sent to all stations worked. No IRC or funds for cards will be required. Amateur radio operators visiting Ottawa during this period are invited to visit this station which will be located within a large centennial exhibit in the R.C.M.P. Training Center, on St. Laurent Blvd., Ottawa, Ontario. For further information, please write to the Commissioner, R.C.M.Police, 1200 Alta Vista Drive, Ottawa, Canada K1A or OR2. Attention: Telecommunications Branch.

TENNESSEE QSO PARTY

Contacts must take place between 2200 GMT May 19 and 2200 GMT May 20. No time or power restrictions. All licensed amateur bands may be used, but operation is restricted to the General class segments.

The exchange will consist of a signal report and QTH (Non-Tennessee particpants will give their State or Country. Tennessee participants will give their County only). Logs must include date, time in GMT, station worked, exchange, band, mode and county multiplier. Stations may be worked on each band/mode. Portables and mobiles may be reworked if they change counties. Logs must be postmarked no later than June 22, 1973 in order to be eligible for award consideration. Send logs to: Mel Wardell K4PJ, Box 489, Oak Ridge TN 37830.

GAITHERSBURG SWAPFEST

The Gaithersburg MD Swapfest will be held Sunday, May 20, at the Gaithersburg Civic Center, located on South Summerset Ave., next to the U.S. Post Office. Talk-in is on 52, 94 and 04/64. For information call Larry W3ZPO at 948-9029, or write to MARC, P.O. Box 611, Gaithersburg MD 20760.

VHF/UHF CONFERENCE

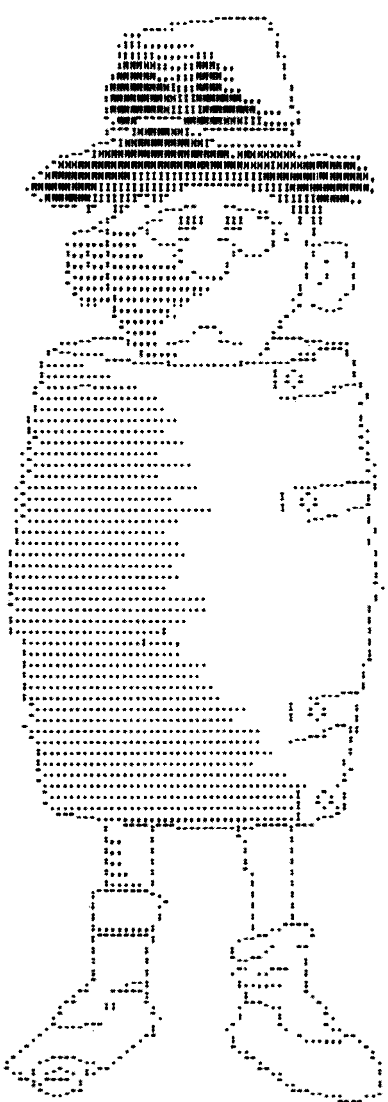
The 1973 West Coast VHF/UHF Conference will be held May 5th and 6th at Pen and Quill Hotel, 3501 N. Sepulveda Blvd, Manhattan Beach CA. The registration fee is $3.00. Those wishing information should contact WA6HXM, Box 2473, Palos Verdes Peninsula CA 90274.

HURON VALLEY SWAP

The Huron Valley Amateur Radio Association will hold its 7th annual Swap and Shop, Sunday, May 27, 1973, at the Saline Country Fairgrounds, Saline, Michigan. Sales will be outdoors from your car, or in case of inclement weather, a large building is available. Plenty of prizes and no parking problems. Donation $1.25, or $1.00 in advance. Contact Terry Marsh, 702 Stanley, Ypsilanti, Michigan 48197. Telephone 313-482-9577.

I AM CURIOUS . . .

The third annual Yellow Thunder Hamfest will be held at the Dellview Hotel in Lake Delton, Wisconsin on May 19, 1973. Afternoon programs will include NAVY MARS, ARPSC and VHF repeaters, with a cocktail hour and banquet in the evening. For further information contact Kenneth A. Ebneter, K9GSC, 822 Wauona Trail, Portage, Wisconsin 53901.



RTTY PICTURE – Courtesy K2AGI

WOODEN QSL?

The Indiana County (PA) Amateur Radio Club, Inc., has just received authorization to operate a special events amateur radio station with the special call sign of WT3REE. Indiana County, Pennsylvania, is known as "The Christmas Tree Capital of the World." Last year over 700 contacts were made and more are expected this year. The station will be in operation from May 17 through May 20 especially on 80 & 40 meters (others if possible). A colorful QSL is available. For further information contact Sheldon K. Davis W3FVU, Indiana County Amateur Radio Club, 98 Rex Ave., Indiana PA 15701.

NY FM HAMFEST

The FM Division of CVT, Inc. (Poughkeepsie Amateur Radio Club) will hold its 1st annual hamfest and auction on Saturday, May 5, 1973, between 11:00 A.M. and 7:00 P.M. at Gerring Park, Fishkill, N.Y. – near routes 52 and 84 intersection. There will be talk-in on W3CVT 37-97 as well as 94 and 52. Refreshments and door prizes – rain date is May 12, 1973. Donations per person are $1.00 admittance, $3.00 for tables. Children under 12 and XYL's admitted free. CVT, Inc., c/o R. W. Perry, RD 1, Glen Ave., Fishkill NY 12524.

NW MISSOURI HAMFEST

The P.H.D. Amateur Radio Association will hold their fourth annual Northwest Missouri Hamfest at Kansas City MO on Sunday, May 6th, in the Kansas City North Community Center, one mile south of Antioch Road-Highway I and 135 interchange at 3930 North Antioch Road. For further information write to them at P.O. Box 11, Liberty MO 64068.

FRESNO HAMFEST

Included in the program for the thirty-first annual Fresno Hamfest will be a Home-Brew contest and a segment of particular interest to the FM crowd. The Hamfest will be held May 4, 5 & 6, 1973 at The Sheraton Inn, Highway 99 & Clinton Ave., Fresno CA. Pre-registration at $10.50 prior to April 27th, and queries may be sent to F.A.R.C., P.O. Box 783, Fresno CA 93712.

HUMBOLDT HAMFEST

The Humboldt (Tennessee) annual hamfest will be held on Sunday, May 20, at Shady Acres City Park, Trenton TN. Prizes, flea market, ladies' activities, and a playground for the children. For more information contact W4IGW, Ed Holmes, 501 N. 18th Ave., Humboldt TN 38343.

SPARC HAMFEST

The St. Petersburg Amateur Radio Club will hold its annual hamfest on Sunday, May 6, 1973, from 9:00 A.M. to 3:00 P.M. at Lake Maggiore, 9th Street So. at 38th Ave., St. Petersburg FL. Registration is $1.00 per family, and extra tickets for prizes will be 50¢ each. Contact Lee L. Kanarian K4WXS, 461 Pinellas Way, So., St. Petersburg FL 33707.

BREEZE SHOOTERS

The 19th annual Breeze Shooters Hamfest will be held Sunday, May 20th, at White Swan Park (Parkway West, 4 miles east of the Greater Pittsburgh Airport). There are no fees and parking is free. Tables and swap-and-shop are available plus the amusement park for your family's enjoyment. Check in on 29.0 MHz and 146.96 MHz. For complete information contact Herb Heller W3OFI, 2873 Beechwood Blvd., Pittsburgh PA 15217.

BURBANK HAMFEST

The Hamfest will be held on Saturday, May 19, 1973, from 10 AM – 8 PM, at the Lockheed facility, which is located just seven blocks east of the Hollywood-Burbank Airport. There is ample parking in paved and patrolled areas with uniformed guard protection. Tickets are good for prize drawings. Hot coffee and cold coke will be served. Attendance runs near 1500. For further information contact William G. Welsh W6DDB, Hamfest Publicity Coordinator, Amateur Radio Club W6LS, Lockheed Employees Recreation Club, 2814 Empire Ave., Burbank CA 91504. Home telephone: 213-848-9340.

WEXAUKEE MI SWAP

The Wexaukee Radio Club is holding their 13th annual Swap & Shop & Eyeball at the National Guard Armory in Cadillac MI on May 5th. Doors open at 9 A.M. Your junk may be gold to someone else. More info from P.O.Box 386, Cadillac MI 49601.

MADISON HAMFEST

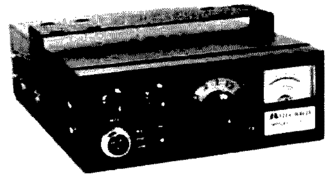
The Madison County Amateur Radio Club presents their annual spring Hamfest Sunday, May 6, 1973 from 10 A.M. till 5 P.M. The location is 4 miles north of Anderson, Indiana (west of state road 9) at the Madison County Civil Defense building (old Linwood school). The Talk-In frequencies to be monitored are 146.94 and 146.22/146.82 MHz FM and 3.92 MHz SSB. All buyers, sellers, and visitors are welcome. Plenty of refreshments and prizes.

ROCHESTER HAMFEST

Preparations are under way for our fourtieth annual Hamfest to be held at the Monroe County Fair Grounds, Rochester, New York, May 11 and 12. We expect to greet over 4000 of the ham fraternity from Eastern U.S. and Canada. For information contact Lawrence E. Brassie WA2GHQ, 524 Parish Road, Honeoye Falls NY 14472.

NEW PRODUCTS

MIDLAND 220 TRANSCEIVER



One of the benefits of the proposed CB band on the low end of our 220–225 MHz ham band is that it has provided that extra inducement to get some of the manufacturers into production with 220 rigs for us. The fact is that they can't lose – if we hold the 220 band it will probably be because we occupy it – this means sales – if we don't hold on to it, the CB influx will make for monumental sales.

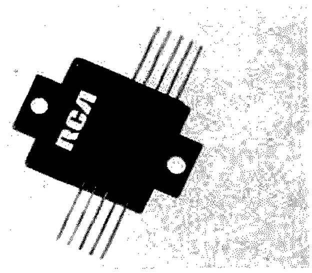
The newest of the 220 transceivers is this one by Midland. It has twelve channels – and that ought to be plenty for some time to come, even in the bigger urban areas. There are several interesting features to this unit, such as crystal warping capacitors on both transmit and receive crystals, illuminated S-meter and r-f monitor, on-off switch separate from the squelch or volume controls so you don't louse up your setting every time you turn the rig off, remote speaker jack on the back panel so you can use the regular car speaker, a low power position for use with batteries or for very local communications – this cuts the output down to one watt instead of the normal ten watts – and, best of all, a jack on the back of the unit for plugging in tone burst, continuous tone, touch-tone, and things like that – plus a discriminator meter output and transmitter keyed output for switching an antenna relay or an amplifier. Midland has thought of almost everything!

Another plus is the better than average instruction booklet – all in English.

The final is protected from mishap—like a shorted antenna – or *no* antenna. This is worth its weight the first time you happen to short out the antenna or disconnect it and turn on the transmitter. Without the protective circuit – blip!

If *Midland Electronics, 1909 Vernon Street, North Kansas City MO 64116* does not jump at the chance to send you more details on this beauty, you write to old Uncle Wayne and you let him know . . . y'hear?

100 WATT OP AMP



A new multi-purpose 7-ampere, low-distortion, operational amplifier has been announced by the RCA Solid State Division.

Designated RCA TA8651A, this developmental power hybrid circuit is a low-distortion, 100-watt linear amplifier. The output section can be externally biased class AB for low intermodulation (0.05% at 50 mW) and low total harmonic distortion. Terminals are available for external frequency compensation, external short-circuit protection, and inverting and non-inverting inputs. The TA8651A is supplied in a compact hermetic package, for which a socket is available for ease in mounting and connecting. Further information may be obtained from RCA Solid State Division, Box 3200, Somerville NJ 08876.

NEW SEMICONDUCTOR REPLACEMENT MANUAL

A comprehensive 52-page Semiconductor Replacement Manual has just been released by Sprague. Containing over 30,000 OEM part numbers listed alpha-numerically which are cross referenced with Sprague's new line of 82 popular semiconductor devices, the manual also includes performance characteristics, outline drawings and pertinent parameters for the entire Sprague line.

Copies of Semiconductor Replacement Manual K-500 may be obtained

without charge from Sprague distributors or by writing to *Sprague Products Company, 517 Marshall St., North Adams MA 01247.*

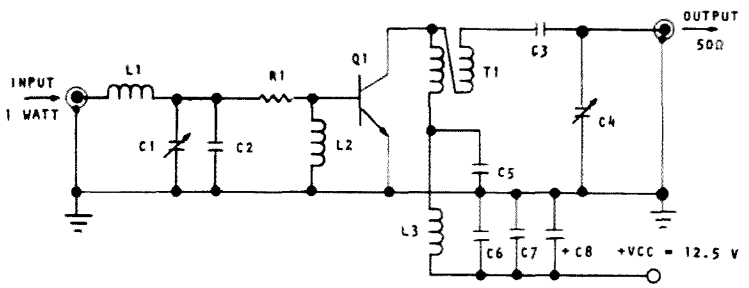
TRW RF POWER TRANSISTOR

The PT5757 is the first of a series of reasonably priced NPN power transistors by TRW that are designed specifically for amateur radio. It is capable of amplifying a 1 watt two meter FM signal to 10 watts and costs only 10 dollars in single lot quantities. The collector efficiency is 70% and the transistor is designed for a handy operating voltage of 12.5V dc.

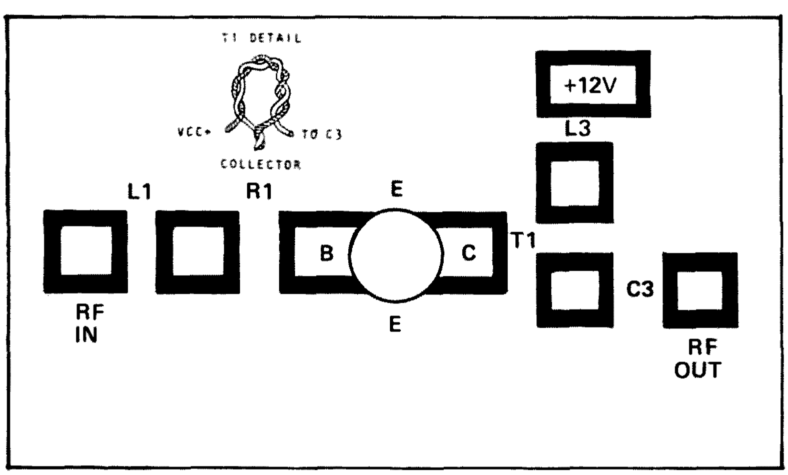
A small 10W amplifier can be assembled in a couple of hours using this transistor. After etching out the pads as shown in the circuit board layout, carefully solder the components onto the copper side of the board according to the placement noted on the board and in the photograph. (If you've never worked with rf power transistors before, construction hints can be had in the two articles on 2m amplifiers by WB4DBB in the Dec. 72 and Apr. 73 issues of *73*.) Be sure to heatsink the transistor with a good zsized piece of thick aluminum before testing. The heatsink need not be insulated from ground. Tune-up consists of adjusting C1 and C4.

The unit assembled here at *73* works great. Driving it with a TR22 increases the transceiver's range considerably! Since the amp is uncomplicated and requires no special parts other than the transistor, it would seem to make a good project for clubs or beginning FM'ers.

The PT5757 is available from any TRW distributor or from *Ham Radio Center, 8342 Olive Blvd., St. Louis MO 63132, (324) 993-6060.*

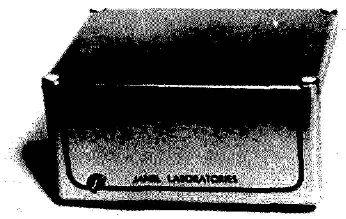


PARTS LIST
Q1 - TRW PT5757
C1 – 51 pF 5%, DIPMICA
C2, C4 – 8–60 pF
C3 – 100 pF DISC
C5 – .001 μF DISC
C6 – .01 μF DISC
C7 – .1 μF DISC
C8 – 10 μF 20V dc
L1 – 4 No. 20 0.3 cm I.D.
L2 – 12T no. 28 0.3 cm I.D.
L3 – 10 no. 20 0.3 cm I.D.
T1 – 4:1 transmission line transformer, made up of a 3" length of twisted pair, no. 20 enameled wire.
R1 – 1.0Ω 5% ½W



Full size layout of the circuit board used for a 10 watt 2m amplifier using the PT5757.

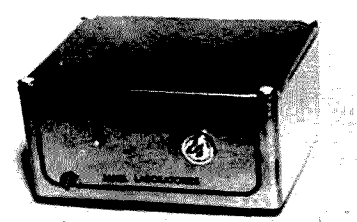
TWO METER CONVERTER



Janel Labs has announced a new crystal-controlled two meter converter that combines performance with low price. This new converter, the 144CC, rounds out the Janel line that already includes the deluxe 144CA high performance two meter converter. Other products include converters for 50, 220 and 432 MHz.

The 144CC uses gate-protected dual gate MOSFETs to provide high sensitivity while avoiding overload effects. One rf stage is used to prevent cross-modulation overload by keeping the signal level low at the mixer. The converter is claimed to be free from birdies, due to the use of a seventh overtone crystal oscillator. This eliminates the need for multipliers and has been found to be very effective in reducing spurious responses. Typical specifications are: Gain – 20 dB, Noise Figure – 3–5 dB, Power – 12V dc with i-f outputs available on 26–30 MHz or 28–32 MHz. The price is $49.95 from *Janel Laboratories, P.O. Box 112, Succasunna NJ 07876.*

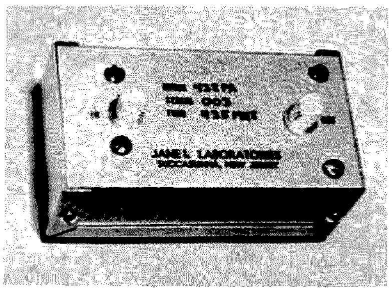
432 MHz LOW NOISE PREAMPS



As part of their line of VHF/UHF products, Janel Labs has announced a series of 432 MHz preamps. Four models are available offering low noise figures in a choice of two price ranges, each having the option of an ac power supply. Models without power supply have a compact sheet aluminum enclosure while those with power supply feature a rugged cast aluminum case.

The gain of all models is an ample 20 dB. Bandwidth (3 dB) is about 20 MHz. Stock units can be supplied for any center frequency between 420 and 470 MHz and other frequencies are available on special order.

The basic circuit is a two stage amplifier. It uses a KMC bipolar tran-



sistor first stage and a 3N159 dual gate MOSFET second stage. The 432PA uses a K2073 first stage to produce a 3.5 dB noise figure and the 432PC uses the new K6007 to achieve an extremely low 1.5 to 2.0 dB noise figure.

The 432PA models are priced from $29.95 to $54.95 and the 432PC models cost from $69.95 to $94.95. They are available from *Janel Labs.*

IS YOUR RIG INSURED?

One of the members of the Electchester N.Y. ARC recently experienced the theft of his car with a trunk full of ham gear. Some of the gear was installed in the car (bolted and wired in place) but most of it was loose and merely being transported, as the owner was leaving on a vacation and intended to operate portable in Pennsylvania.

The car was insured and covered for "comprehensive." Do you think that covers radios? Unless you have a special policy, you are probably not covered. The usual coverage extends to what is required to make the car operative plus luggage and clothing up to a limit. Cameras, sporting goods, tape decks, recorders, stereos and radios are not covered unless you have a special policy giving such items specific coverage. Better read your car policy carefully if you think it covers you – it's just about a lead pipe cinch it does not.

The New Yorker also had a Homeowners policy with off-premises coverage for personal property which he was sure gave him coverage. Wrong again. In 1971 most insurance companies doing business in New York State changed their policies due to the tremendous increase in thefts from cars.

Check your policy! Radios, stereos, tape decks, cameras, etc., are covered only if specifically stated in the policy when they are lost off the premises. Unless your agent has changed your policy to cover your radio gear, the chances are you are not covered. Better get it out, give it a good look, and then check with your agent to make sure.

73's WORLDWIDE SALES REPRESENTATIVES

U.S. AREA REPRESENTATIVES

New Mexico/West Texas
Ambrose G. Barry, W4GHV/5
1010 Juniper Avenue
Alamogordo, New Mexico 88310

State of Michigan
Gloria M. Ligon, K8WKE
47160 Condor Street
Utica, Michigan 48087

DX REPRESENTATIVES

BCN Agencies Pty. Ltd.
178 Collins Street
Melbourne 3000, Victoria
Australia

The Wireless Institute of Australia
478 Victoria Parade
P.O. Box 36
East Melbourne, Victoria
Australia

Carlos Rohden
Caixa Posal 5004
Sao Paulo, S.P.
Brasil

Jim Coote
56, Dinsdale Avenue
Kings Estate
Wallsend
Northumberland, England

Radio Society of Great Britain
35 Doughty Street
London WC1N 2AE, England

Short Wave Magazine
55 Victoria Street
London, SW1, England

Bryan Fogerty
Irish Radio Transmitters Society
9 Wellington Street,
Dun Laioghaire, Eire

Orion Books
13-19 Akasaka 2-chome
Minato-ku
Tokyo 107, Japan

Tama Electronics Co., Ltd.
Towa Building 502
515 Higashi Oizumi, Nerima-Ku,
Tokyo 177, Japan

Sun Electron Corporation
15–20 Takaban-1-chome
Meguro-ku, Tokyo 152, Japan

Kushal Harvant Singh
83, Aulong Road off Stephens Road
Kampong Boyan
Taiping, Perak, Malaysia

Gordon and Gotch Ltd.
P.O. Box 584
Auckland, New Zealand

G. H. Gillman
Smarts Road
Waikuku RMD
Rangiora, North Canterbury
New Zealand

New Zealand Assn. of Radio
Transmitters
P.O. Box 1459
104 Hereford Street
Christchurch, New Zealand

Harold C. Leon
P.O. Box 61141
Marshalltown, Transvaal
South Africa

South African Radio Publications
P.O. Box 2232
Johannesburg, South Africa

South African Radio Relay League
P.O. Box 3911
Cape Town, South Africa

Julio Antonio Prieto Alonso, EA4CJ
Donoso Cortes No. 58
Piso 50, Letra B
Madrid 15, Espana (Spain)

Eskil Persson, SM5CJP
Frotunagrand 1
194 00 Upplands Vasby
Sweden

"Chief, those CB'ers are working DX again."

John W. Crawford WA4SAM
1552 Cameron Crescent Drive
Reston VA 22090

MOBILE BURGLAR ALARM SYSTEM

At 9:20 p.m. on a Friday evening last year, my wife and I were enjoying a play at a theater in Norfolk, Virginia. She, as usual, complained bitterly about the HT-220 I had on my belt that made me look like a detective. (Why couldn't I use a "thing" like doctors have – i.e., a pager.) It was the quietest part of the performance. Suspense hung in the air like a cloak, the stage was hushed and there was not a sound from the audience. Suddenly, BANG! There was a loud, shrill noise – a 1 kHz tone – that seemed to burst from the audience like a child demanding attention. I jumped out of my shoes; then realized it was my HT-220 sounding off.

Having cleverly gotten seats in the center of the theater, I ran to the aisle, ruining twelve pair of shoes doing so. There was an exit door straight ahead which seemed to lead to the side of the building. I ran to it like a fool, with the "thing" still beeping – I couldn't find the volume control in my excitement. The door was heavy metal, designed to lock when shut but allowing for easy egress. I passed through it. When it shut, it insured that any hope of going into *that* theater in the future may as well be forgotten. My wife said later that the audience thought there was an explosion. Standing on the steps, I looked for my car. The intermittent beeping could be only one thing – the tamper alarm on my car was being triggered.

Myopically squinting in the dark, I could see there was a man (larger than I) sitting in the front seat of my car. I ran over to him and, because of the difference in size between us, politely asked the gentleman why he was there. He had been happily unscrewing my tape deck, but he paused, surprised, as I did so. At the same time, he shifted in the seat. Realizing I was outnumbered both in size and weight, I opened the door and grabbed my hidden .32 pacifier.

The alarm had been set and went off – loudly. Clearly, the man did not know what to do. Neither did I, for I had not drawn a gun on anyone in my life. I decided to seek sanctuary in the theater, and I directed him to walk to the main entrance. It was interesting to note the look on the ushers' faces as I escorted the man at gun point into the posh theater with 1,100 people watching the play.

Later, in the police station, the surprised thief learned how he was caught. The secret is a small 1W General Electric Voice Commander II transistorized transmitter to which a tone generator is attached. This is triggered by an assembly, fastened to the car, which consists of a piece of spring steel with a lead weight on the end. As the car is moved, the weight causes the spring steel to ground against an adjusting screw. The adjustment can be set so that driving down the street will barely close the contact or so that blowing on the car will trigger the alarm. This device has been marketed under the name "Devil Dog" by Northwest Electrical Company, Mitchell, South Dakota.

The alarm system itself consists of several relays and parts arranged in such a fashion as to set off a mechanical siren, a Federal electronic siren (in the "yelp" mode) and intermittently the horn and high beam headlights. Additionally, separate contacts close for the transmitter. Thus, if the car is tampered with or bumped by one of those lazy drivers who get out of a parallel parking space by backing until they hit something (my car), a pulsing beep is heard in my receiver. If they open something (the rear lift gate, doors or hood), the alarm goes off and a steady tone is heard.

It is worthy to note that the system really works on a dependable basis. My car was broken into nineteen times while I was in Norfolk, Virginia. Eighteen times the alarm sounded and scared the intruder off. The

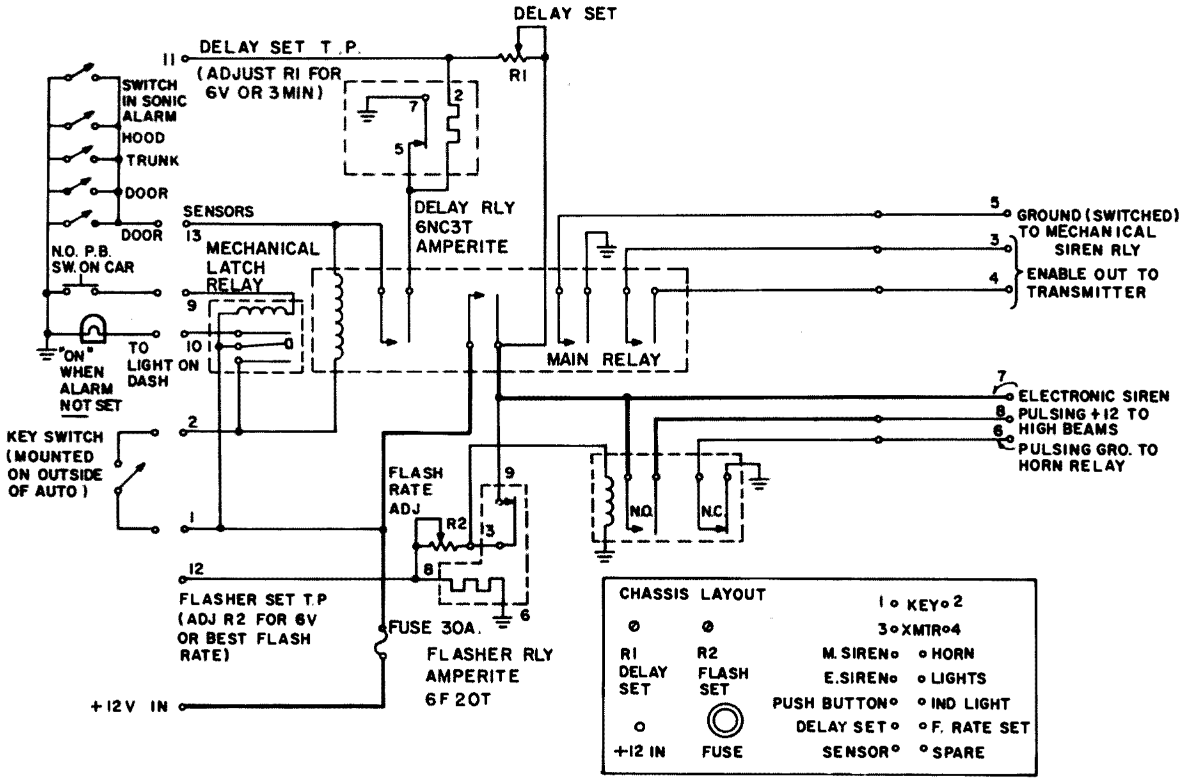


Fig. 1. Main switching system – master alarm. 1. Heavy lines indicate #16 (or heavier) wire. 2. All parts mounted in 6x3x4 minibox mounted on firewall. 3. R1 = 40Ω; R6 = 40Ω. 4. Mechanical latch relay surplus. A Volkswagen headlight dimmer relay may be used here.

nineteenth time, as described above, a window was broken and, due to a broken wire, the seat switches did not work. If it were not for the transmitter, everything would have been lost. Still, I was not happy about depending on the transmitter only, so I installed one more fail-safe device – a sonic alarm.

The basic alarm system has been described in another article (*C.Q. Magazine,* August 1971, p. 54, "The Ultimate in Automobile Alarms, Part II") and is presented in Fig. 1. Basically, I used electromechanical devices to keep this as simple as possible and not have to worry about temperature extremes affecting critical semiconductors. Sensors are the door interior light switches and an extra switch has been added to each door to insure reliability.

The transmitter keying circuit is shown in Fig. 2. Any transmitter can be used, either positive or negative ground. Various brands are out on the market and advertised in the ham magazines. I am using a G.E. Voice Commander II board, which is positive ground. Two Burgess 4F5H 7.5V batteries are used in series since this is not easily compatible with the negative ground system in the car. These batteries are about $6 each but have been in operation for over a year with full voltage still showing under load. The transmitter board was housed in a mini-box and holes were drilled over the adjustments to facilitate tuning. Also in the mini-box is a tone oscillator wired into the microphone circuit through a coupling capacitor, and a tone encoder board which will be discussed later in this article.

The antenna deserves special mention. I have had some ripped off (literally) in the past and needed some unlikely way to effectively radiate a signal the length of a massive parking lot, into a building and downstairs into a theater through steel beams and cement, etc. At the same time, I did not want it to show. After investigating the possibilities in my 1972 Hornet, I decided to mount it inside the rear window.

The feed line from the transmitter follows the various channels through the car into the molding between the roof and rear window. A hole drilled into the side of the molding allows the coax to protrude about three inches. The shield is stripped back one inch and clamped to the metal directly above the window glass. The inner conductor was soldered to a piece of #22 bare wire. The other end of this wire has a loop formed in it and is soldered to prevent deformation or slippage of the anchor string. A piece of nylon fish line is passed through the loop, tied securely and the end heated to prevent it from slipping free. This anchor line is run the remaining depth of the window to a spring which holds the antenna taut.

There are various other ways to mount the antenna, depending on the model of the car and your ingenuity. I own a station wagon with a lift gate and had to enter from the top of the window with enough slack in the coax to prevent the line from bending back and forth and finally breaking as the rear was opened and closed. Regular sedans can be attacked from underneath the rear ledge just inside the rear window, running the antenna up to the inside window molding at the top of the glass. It is anchored as described above.

To tune the antenna I used a through line wattmeter and an SWR bridge. Keying the transmitter, the wire was cut and pruned from a length of 30 cm in half cm increments until the SWR went as low as possible. The actual length turned out to be 27 cm but this will vary from car to car due to the adjacent metal (or lack of metal).

The receiver used for a long time was an HT-220. This was great until one night at a movie, with the volume turned up, W4 . . . announced that he was QRZ on the frequency, to the embarrassment of my wife, and stares from fellow movie-goers. This happened many times on subsequent occasions. There was no one frequency clear all the time. Also, there were some frequencies on which I could not go because they happened to be local repeater input frequencies. Finally, after some searching around, I came up with a used tone access Page Boy receiver. I modified it to the 2 meter FM band and removed the reeds. In their place I installed an HT-220 P.L. board. A reed relay was installed in this P.L. board and an encoder to generate a tone corresponding to that reed decoder was installed in the transmitter mini-box. This was much better. The receiver will not sound unless my own particular transmitter is activated. Then it beeps or sounds a steady tone, depending on what is going on in the car. The encoder was built from an article in *73 Magazine*, but a better circuit appeared in the February '73 issue (p. 37). The actual encoder used is unimportant, but the frequency should be the same as the P.L. reed relay used.

Choosing the transmitter output should be done judiciously. It is not nice to trigger the local repeater with your alarm. A busy channel will not be suitable if you do not have P.L. If you do, your car may interfere with other QSO's. In my area, 94 is relatively quiet with respect to the places I frequent. My coverage is about three miles. 97 and 91 are local repeater output channels with others spaced in every possible frequency spread. I finally put the transmitter output on 146.94 after considering possibilities outside the normally used ham

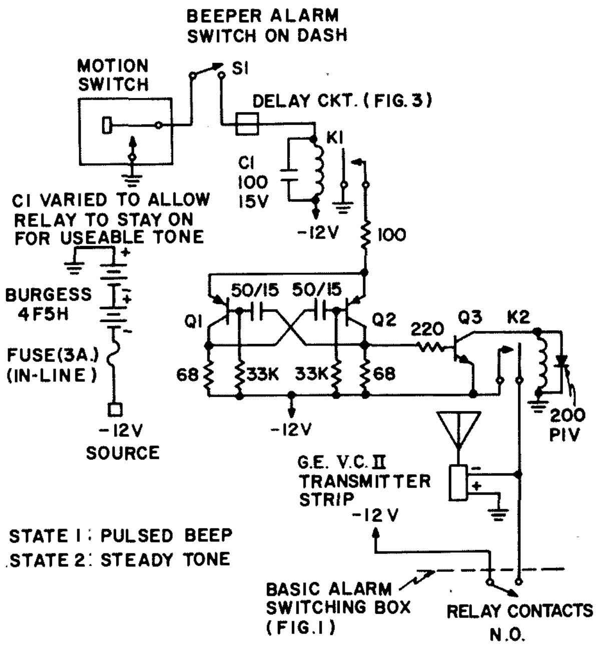


Fig. 2. Transmitter keying circuit used in a 1972 Hornet. The transistors are any audio or small signal type; Q1,2–PNP; Q3-NPN. Adjust the 50µF capacitors and the 33K resistors at the bases of Q1,2 for best pulse rate.

frequencies (146.955 or below 146). This was only because I wanted to use the pager on 94 at certain times. Also, there are more hams with 94 crystals around and no matter where I am, if somehow the car *were* stolen, I could enlist the aid of local hams in locating it. If P.L. is not used, however, a quiet channel is a must. If you must split channels, this may be done (i.e., 146.955) but unless your receiver is very narrow band, 94 and 97 will spill over on high frequency peaks.

There are certain legalities involved here. The FCC requires your call be transmitted when you key your rig. In addition, regulations exist to prevent unauthorized persons from keying your transmitter. The latter I overlooked because, in effect, by setting the alarm, I am the one who controls the transmitter – the only device needed to make it transmit is a thief, which can be compared to a remote relay or switch in this respect. The former is a little harder. However, there have been several repeater code identifiers written up and one of these could be used rather than the 1000 Hz tone. Perhaps in the future a touch tone encoder will be used with my HT-220 to provide control of the alarm transmitter.

The complete tamper alarm schematic is shown in Figs. 2 and 3. It uses switch SI to complete the circuit between the sensor(s) and the relay. The capacitor (CI) across the relay keeps it closed as long as the sensor is clapping. A multivibrator circuit was used to turn on a transistor, thereby keying the transmitter. This will work if you find a very low leakage type. However, in my case, the transmitter was partially on even with Q3 biased off, so I used it to turn on a relay (K2) instead, which provides positive control of the transmitter. Shorting these contacts are the main alarm system relay contacts which cause the transmitter to stay on as long as the automobile alarm is going off.

Undoubtedly there are better ways of doing this. Transistors may be used in place of most of the relays, a toggle type flip-flop can be used in place of the multi-vibrator, a P.U.T. or U.J.T. can be used in place of the thermal relay, etc. However, this was purposely kept as simple as possible and as cheap as practical. The junk box has most of these parts, so I used them up rather than

keep them around. Also, since my system runs off the aforementioned batteries, I wanted as little current drawn as possible (i.e., none). To bias a transistor off requires only a few microamperes, but several in a system can shorten the life of those expensive batteries by one half. Batteries were considered very necessary not only because of the positive ground requirements of the transmitter, but also because an enterprising thief has only to cut your car battery lead from underneath if he suspects you have an alarm. The one I caught in Norfolk had enough brains to realize I might have had an alarm, which is why he broke a window for entry. If the alarm does not go off, at least this will be a fail-safe device.

Sensors may be the above Devil Dogs or mercury switches suspended in such a manner as to close when the car is moved. The Devil Dogs are probably the best idea and several may be scattered around the car in strategic places and angles. If more than one is used, it is preferable to place them at 90° to each other to compensate for any motion – lateral, up-down or angular.

The only other part of the system is a must for a station wagon. An ultrasonic alarm is available for about $40 from Radio Shack. Mine is a Mallory CA1 dc Crime Alert which was already on hand. If a window is broken or a hand is stuck in through an open window, the car alarm is set off. It is mounted in a corner in the rear of the car facing toward the front. There is an inherent 20-second delay before it arms. A switch in the front of the car (next to the tamper-set switches) sets this alarm. Any movement inside the car changes the received 40 kHz frequency and triggers a relay in the unit, which grounds the interior light system. This in turn sounds the main alarm if the key or pushbutton switches have been set. To get into the car, the main alarm is disarmed and the door opened. As this closes, the sonic alarm will sound until you turn the control switch off. This is effective in checking its operation. I have it hooked to the 15V batteries because the greater voltage provides a stronger field. With all the carpeting and foam rubber in the seats, the field is reduced significantly. One useful addition would be to trigger the alarm transmitter inde-

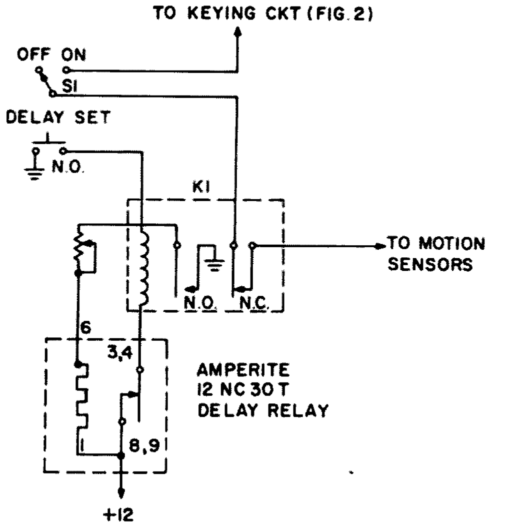


Fig. 3. Delay circuit for transmitter. S1 from Fig. 2 is incorporated into this diagram.

pendently of the main alarm with this unit, in case of failure of the tamper sensors.

Some sort of delay circuit is needed to give the sensors time to settle down so the car will not beep after you get out of it. The circuit of Fig. 3 shows how this was accomplished. A delay relay and relay K1 are energized by means of a front panel switch S1. When the delay relay resets, relay K1 de-energizes to its normally closed state, thereby connecting the sensors to the unit.

The alarm has been quite dependable and only a few modifications have been made to improve it. One of these was the set-release pushbutton switch mounted behind the driver's door handle. The A.M.C. cars have the flush door handles that you grasp from within a well in the door and pull out. The miniature pushbutton switch hidden behind this latch is invisible and invaluable for quick stops. It triggers a mechanical latching relay which shorts the key switch contacts when pulsed. In the unset position, another set of contacts turns a light on the dashboard on. Thus, when the light is out, the alarm is set.

For those of you in high risk areas, this should be the answer to your problems. I would like to hear from anyone who tries it and has the method work, and whether an arrest was made or not. If enough people install this, maybe we can all lobby for cheaper theft insurance rates, or even be able to get coverage for uninsurables like tape decks, etc.

. . .WA4SAM

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The burst circuitry can be mounted in a box with a touchtone pad for total operating convenience.

THE BURST BOX

Incorporated in "The Burst Box" is a versatile tone generator that features two output ranges. Continuous sub-audible or high frequency bursts may be switch selected for use with various repeaters.

The Tone Burst Box is more often becoming a requirement to key up desired FM repeaters. Generally speaking, the new solid state transceivers don't have room for the additional circuitry required to generate a tone burst. This article describes an outboard box requiring no batteries, deriving power from the transceiver, but using only a two wire connection so that miniature earphone jacks are sufficient. A touchtone pad may also be included in the box for mobile telephone operation.

The circuit works as follows: switched power is derived from the transceiver at a terminal which goes positive during transmit. This will be the collector supply for the multiplier and buffer amplifier stages. This power is fed through a 330Ω resistor down to a convenient earphone jack and down the cord to the burst box. It then goes through a 200Ω resistor and charges a 100 μF capacitor. The capacitor provides B+ to a CMOS square wave oscillator whose frequency is adjusted by the 1 meg potentiometer and the selected .001 or .01 capacitor giving a

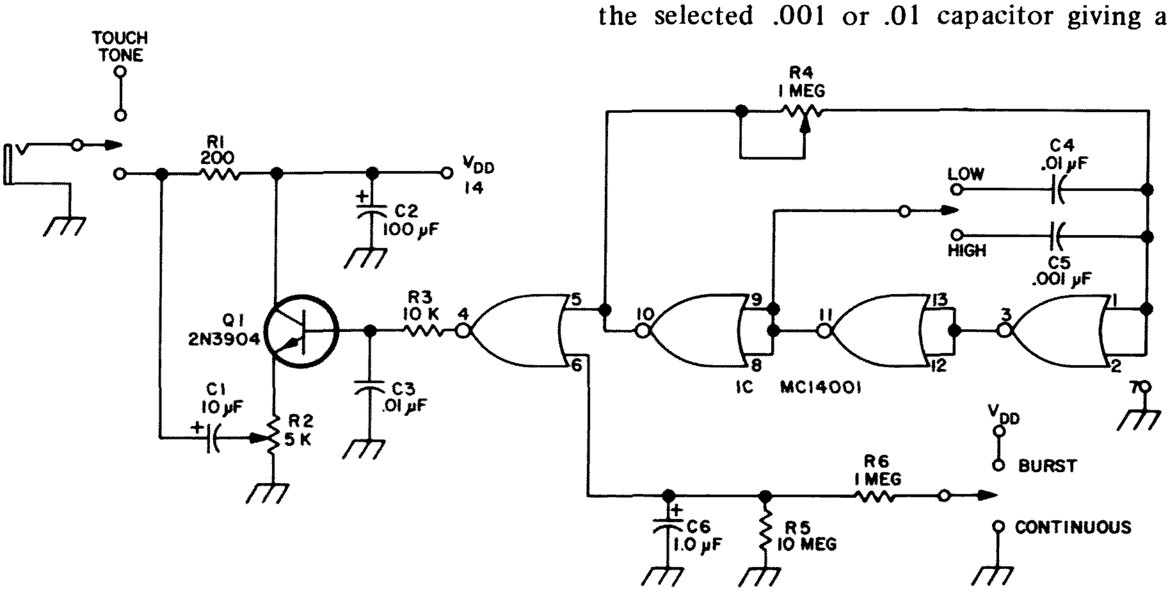


Fig. 1. Schematic diagram of the tone generator used in the Burst Box.

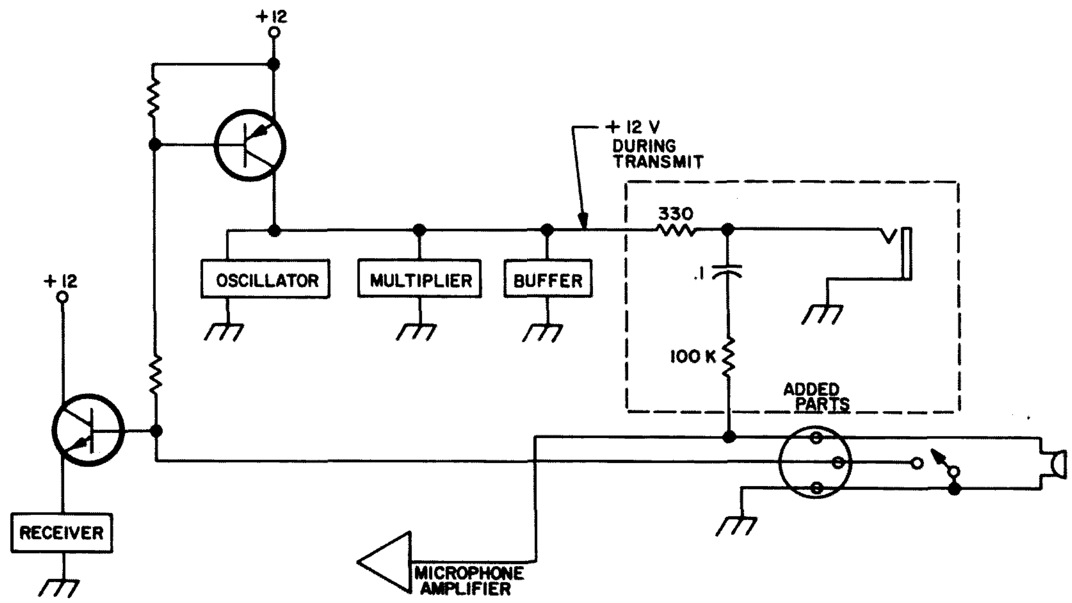


Fig. 2. The area inside the dotted lines show the extra components needed for connecting the Burst Box to a transceiver. Power is drawn through the 330Ω resistor.

frequency range of 100 Hz to 1 kHz or 1 kHz to 10 kHz (f≈1/RC). In the burst mode, a 1 MΩ resistor charges up a 1.0 μF capacitor in roughly .6 second which gates off the square wave. High frequency components of the square wave are filtered by the 10 KΩ and a .01 μF capacitor. The emitter follower drives the volume control, which couples signal as an ac component superimposed onto the dc coming from the transceiver. This ac component is coupled off inside the transceiver by a .1 μF capacitor and a 100 KΩ resistor, feeding the audio to the microphone input circuit, but not loading or biasing the microphone.

Construction

First locate the place in your transceiver where transmit B+ (+12V) can be tapped. Next, locate an earphone jack at a place where it may be conveniently mounted. Now solder in the 330Ω, .1 μF, and 100K resistors. The burst box is now constructed in any convenient chassis. If desired, the same box may be used for a touchtone, and the power and signal for it derived in the same way.

The circuit should be constructed using a 14 pin dual inline socket and some small scrap P/C board. The CMOS quad two input NOR MC14001 should be handled with some caution. It is shipped with its leads in a black conductive foam. When the box construction is complete, remove it from the foam and plug it in.

Be sure to check that pin 1 of the package is in pin 1 of the socket and connects to the frequency potentiometer. Do not put the MOS device in styrofoam, or put it in a plastic tray, since static electricity may destroy its high impedance gates. I have found these devices to be rugged and have

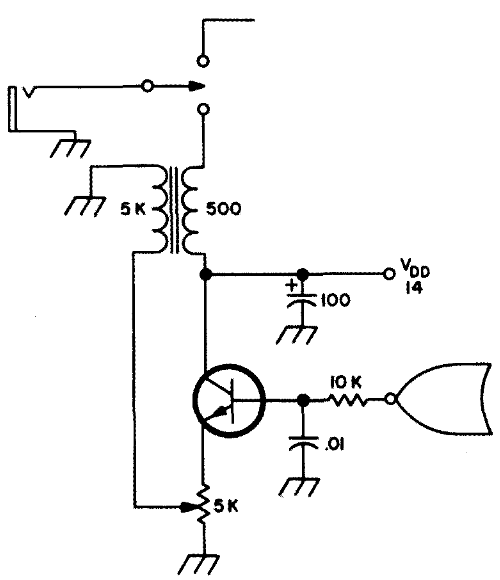
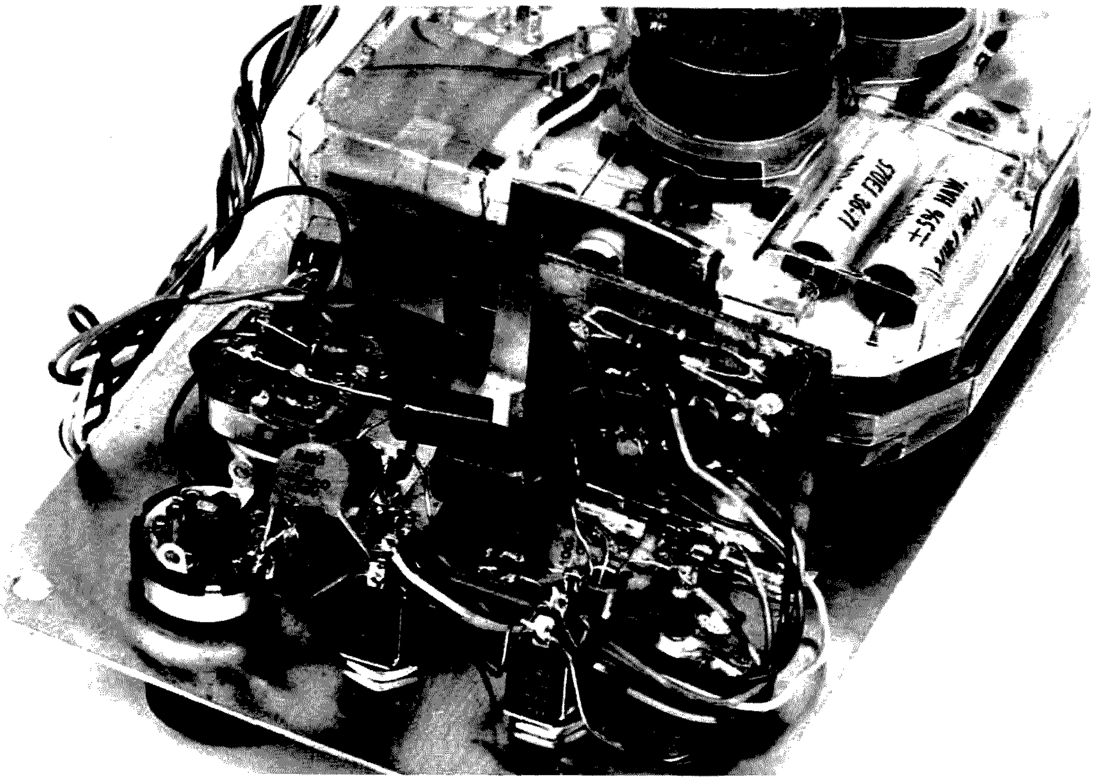


Fig. 3. The output from this alternate circuit looks more like sine waves than that from Fig. 1.



Inside of burst box. The IC is mounted on the upright PC board near the center of the panel. R4 and R2 are at the left.

never burned one out, but the manufacturer suggests caution.

After checking the wiring, try it.

Operation

The face to the box should be frequency calibrated, either in kHz steps or by marking locally used frequencies.This can be done with a scope and calibrated audio generator. Set the frequency range switch to whatever range is necessary in your area; set the burst-continuous switch to continuous. Couple +9V through a 330Ω resistor, making sure the positive side connects to the 200Ω resistor inside the box. Pick audio off the 330Ω resistor into the oscilloscope vertical input, and the audio generator into the horizontal, and adjust for a Lissajous pattern. Note that the burst box does not generate sine waves. (The waveforms generated will more closely resemble sine waves if transformer coupling instead of capacitive coupling from emitter follower to transmitter is used.) Calibrate the frequencies on the face plate. If your repeater uses continuous sub-audible tones, use the low frequency and continuous-mode. If your repeater uses tone burst, use the high frequency and burst mode. On direct (simplex) turn the volume all the way down or switch off the burst box.

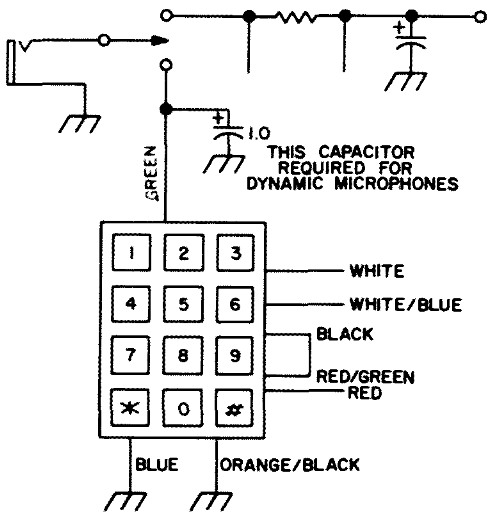


Fig. 4. Diagram showing touchtone connections to the Burst Box.

Thanks to Jim Jeager WA8KDR, for his assistance in this project. . . .WA7NMO

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POWER INVERTER WITH SINE WAVE OUTPUT

Why put up with noise generated by square wave inverters when you can get 60 Hz sine wave output at little extra expense?

How would you like to have a 115 volt 60 cycle outlet in your car? It would be extremely convenient for use with that receiver, transmitter, or tape recorder having only a built-in ac power supply. For around $30 you can buy a little 100 watt solid state inverter using power switching transistors; but wait til you connect your nice store-bought power inverter to a device having a high gain audio amplifier in it. I'm afraid you will be in for quite a shock. The sharp-cornered square wave output often with accompanying sharp little spikes all too frequently seeps through to your low level, high gain audio stages producing the most annoying cacophony of sounds you have heard in a long time. The simple square wave output power inverters are great for razors, electric drills, soldering irons, and even some electronic gear, but for more demanding requirements you need an inverter with a good old sine wave output.

The expense and number of parts required to build a sine wave power inverter are not much greater than for a noisy square wave switching-type supply. Just an additional three or four small transistors, a dozen or so resistors and capacitors, two or three pots and a small driver transformer are all the extra parts that are needed. A glance at Fig. 1 will suffice to show that the basic idea of a sine wave power inverter is exceedingly simple. The block diagram reminds one of a simple 80 meter CW transmitter, and this comparison is quite valid. Basically only the frequency is different; 60 Hz instead of 3.5 MHz. And generating 100 watts of sine wave ac is considerably simpler at 500,000 meters (60 Hz) than at 80 meters (3.5 MHz). A typical circuit is shown in Fig. 2. I do not particularly recommend this circuit over other similar circuits which you can easily devise. The essentials are a sine wave oscillator, a buffer amplifier, and a power amplifier. Let me make a few comments about the requirements on each.

The Oscillator

The oscillator can be any type, but a good choice for practical reasons is one using

Fig. 1. Block diagram of a power inverter with sine wave output.

RC combinations. Even an oscillator using an inductor-capacitor combination such as the Hartley or Colpitts can be used at 60 Hz, but the problem of varying the frequency in order to adjust it to 60 Hz is made much, much easier by using an oscillator whose frequency is determined by an RC network, since the frequency can then be adjusted by merely setting a potentiometer. In Fig. 2 the 10K potentiometer in the oscillator section enables one to adjust the frequency. Make sure your oscillator does produce a sine wave. Some RC oscillator circuits are designed to produce square waves and others a sawtooth output. Don't use these, or you will end up with an inverter that is as good a hash producer as the simple power-switching type. The 3.9K potentiometer in the oscillator section of the circuit shown in Fig. 2 controls the amount of gain in the feedback loop. Too much gain will result in severe distortion of the sine wave.

The Oscillator Frequency

Incidentally, there may be times when you will want to run your inverter at other than 60 Hz. I at one time used my inverter to power a reel-type tape deck operating in my car. In order to run through a 60 minute reel containing voice material during a drive which normally required 50 minutes, I ran the frequency at about 70 Hz, thus speeding up the tape deck motor. This procedure would certainly not be acceptable with music, but you soon adapt to the slightly higher pitch of voices. This approach would be a natural for varying the speed of a code practice tape. You should, however, carefully check that your equipment, and in particular its motors and transformers, can be operated without overheating before subjecting it to use for extended periods of time at frequencies other than 60 Hz.

How can you set your oscillator to 60 Hz? Any of the standard ways of measuring an audio frequency can be used. You might compare your oscillator's frequency with the commercial line voltage frequency either by observing Lissajous figures on an oscilloscope or by listening to and setting the beat frequency to zero. Or if you have access to a digital frequency counter, go first class and use it to measure and set the frequency to 60 Hz.

Output Voltage

In addition to having the frequency right, you will want to have the output voltage

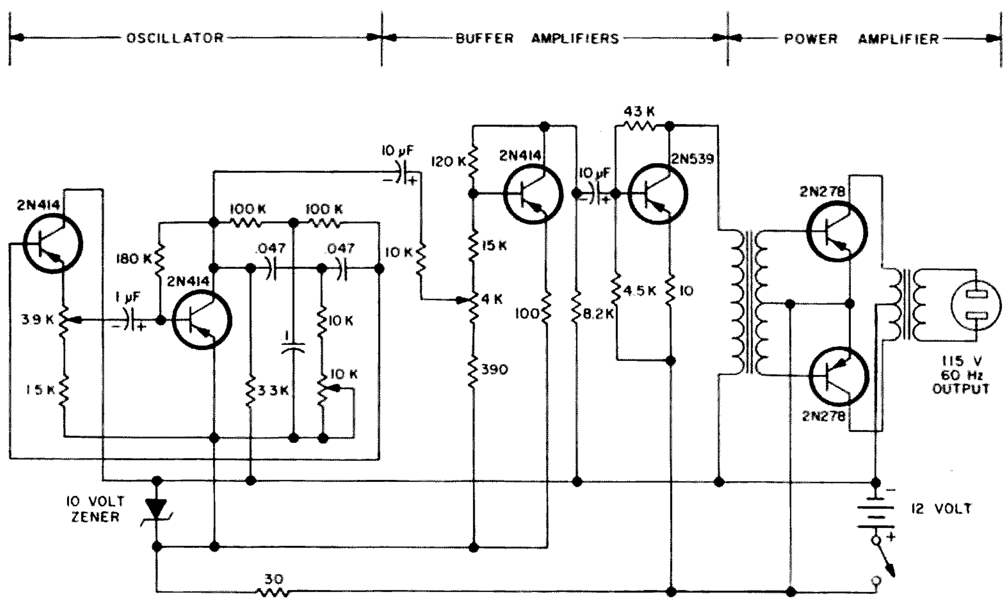

Fig. 2. Schematic of the sine wave output power inverter. The inverter is nothing more than a vfo controlled, push-pull output transmitter operating at 60 Hz. Frequency can be varied by the 10K potentiometer in the oscillator section. The transformers in the output stage can be any filament transformers with adequate power ratings.

reasonably near the desired range of 115–120 volts. In the circuit of Fig. 2, the output voltage is determined by the setting of the 4K potentiometer between the oscillator and the buffer amplifier stages. Of course this pot is nothing more than what we would normally call a volume control, and the following amplifier stages are merely conventional audio amplifiers, operating in our case at 60 Hz. If you want a deluxe setup for continuously monitoring the voltage output of your inverter, you can build in a standard ac voltmeter. A simpler and less expensive approach which will enable you to monitor the output voltage quite adequately is illustrated in Fig. 5. A simple voltage-divider resistor network is used in connection with a small neon lamp to indicate the output voltage. The neon lamps indicated are the type requiring an external resistor for operating on 115 volts. R1 and R2 are selected by trial and error so that the first neon lamp ignites at 110 volts, and R3 and R4 are chosen so that the second neon starts at 120 volts. Then by setting the potentiometer controlling the voltage output so that the first neon lamp is on and the second is off, you are assured that the voltage output is in the range 110–120 volts. Depending on the type of neon lamp used, suitable values for R1, R2, R3 and R4 will lie in the range 30 K to 150K.

The Buffer and Power Amplifier

The particular circuit and transistors chosen for the buffer amplifiers is completely non-critical. Any sort of audio amplifier with sufficient oomph to drive the power amplifier will be quite satisfactory. Just remember that you will need good bass response since the operating frequency is 60 Hz. In other words, don't scrimp on the size of the coupling capacitors. The same general remarks apply to the power amplifier. The input and output transformers need not be regular audio transformers. In fact, you will be better off using ordinary 60 Hz power transformers. The driver transformer, for example, could be a small power transformer having three filament windings. One winding could be used for the primary, and the other two in series could make up the center-tapped secondary. A center-tapped filament transformer would be quite suitable for the output transformer. With a 12 volt dc supply, one would expect the power amplifier transistors to produce an ac voltage in the range of 7–9 volts peak value or 5–6.5 volts rms. Thus a 12 volt center-tapped filament transformer with its 115 volt winding used as the secondary or output should be quite satisfactory. The size or current rating of the filament transformer is determined by the amount of power you will want to handle. A 5 ampere, 12V transformer will be quite adequate for powers up to 50 or 60 watts. The possibility of paralleling transformers in order to take care of higher powers should not be overlooked.

The choice of transistor type to be used in the power amplifier is determined largely by how much power you need to develop, and by what transistors you may have available. I insured adequate cooling of the 2N178's used by immersing them and their heat sinks in a large volume of antifreeze. The five leads were brought out through insulated feedthroughs soldered into the wall of the antifreeze container, making a splash and spill proof assembly.

Efficiency

The power amplifier stage operates Class B, or nearly so. The theoretical efficiency

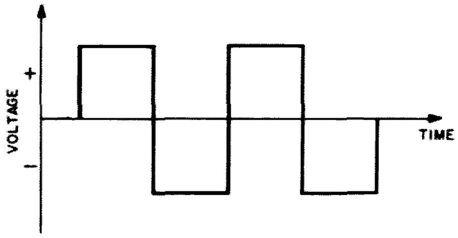

Fig. 3. Idealized output wave of a power inverter using power switching transistors.

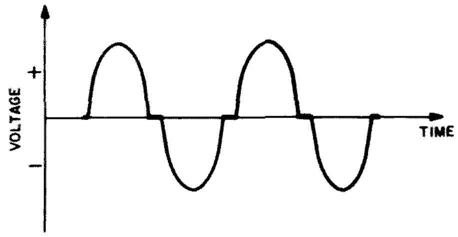

Fig. 4. Output waveform of power inverter shown in Fig. 2.

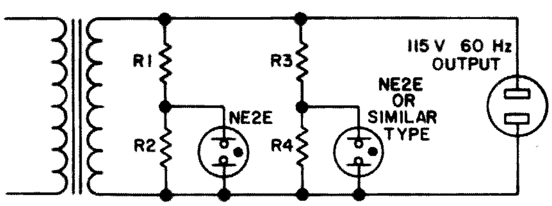

Fig. 5. A simple scheme for monitoring the output voltage.

for Class B amplifiers is 78.5% with practical amplifiers achieving 60–70% efficiency. Assuming that your power amplifier turns out to be 65% efficient and that you are delivering 100 watts to a 115V 60 Hz load, how many amps will your 12V battery have to deliver to the power inverter? Working through the arithmetic involved indicates that the load on the battery will be 14–15 amperes.

Waveforms

The actual waveform obtained from my inverter departs slightly from a true sine wave. As can be seen in Fig. 4, each power transistor of my power amplifier has an operating angle slightly less than 180λ, that is, Class C type operation is being approached. A small shift in bias would bring the amplifier back to true Class B, but since no noise pickup is observed, the additional effort to change the bias did not seem worthwhile.

A Caution

Transistors are quite sensitive to temperature. This fact was brought vividly to my attention when I discovered that my power inverter in its original form would not function on cold winter days until the interior of my car warmed up. The oscillator would simply fail to take off because the gain in the feedback loop was too low. This sad situation was corrected by making the 3.9K potentiometer accessible so that it could be manually reset to increase the gain in the feedback loop. After the temperature rose, the gain was then lowered to prevent distortion of the waveform.

If you are looking for a simple way to run gear having built-in 60 Hz supplies in your car, this sine wave power inverter may well be your answer.

...W7OXD

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EASY PREAMP FOR 450 MHz

With the wide availability and low cost of used 450 MHz commercial transceivers and also with the new FM transceivers on the market, the 450 band is really enjoying popularity. Many 450 repeaters are also being combined with VHF repeaters. Good 450 coverage is essential to a remote base system if it is to be used from a mobile control point. The mobile receiver is often the weakest link since it is affected by local noise that does not bother the mobile transmitter or remote receiver. Since most 450 tube radios have trouble hearing signals weaker than .8 μV or so, addition of an rf preamplifier will make a significant improvement in receiver sensitivity and quieting.

Here is a simple 450 preamplifier that can be built easily, using a minimum of parts. It will provide up to 10 dB of gain with a noise figure low enough to provide a major improvement when used with older tube type receivers. Detailed construction description is included to assist the inexperienced builder.

Circuit

Figure 1 shows a single stage common base amplifier. The simplicity of this single stage amplifier allows for the use of a minimum number of parts. Addition of a second stage would not be justified unless the receiver to be used were really poor. The 800 pF dc blocking capacitors allow the use of trough-line inductors to simplify construction. 1N914 diodes may be added in parallel at the input jack to protect the transistor from burn-out by a nearby trans-

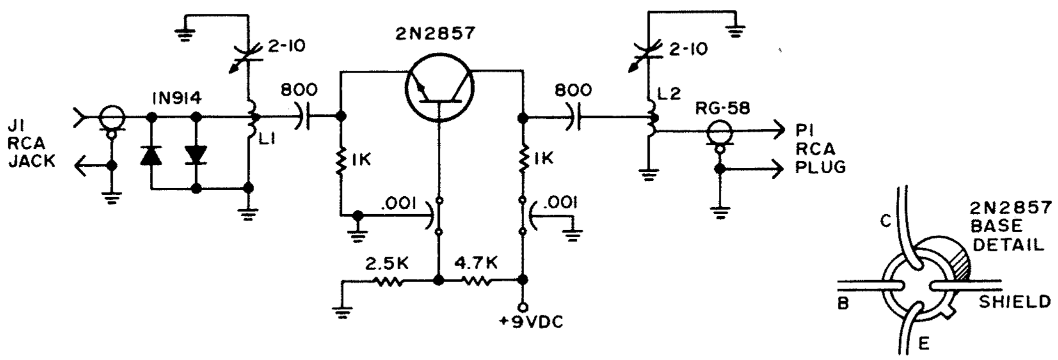


Fig. 1. Schematic of the 450 MHz preamplifier.

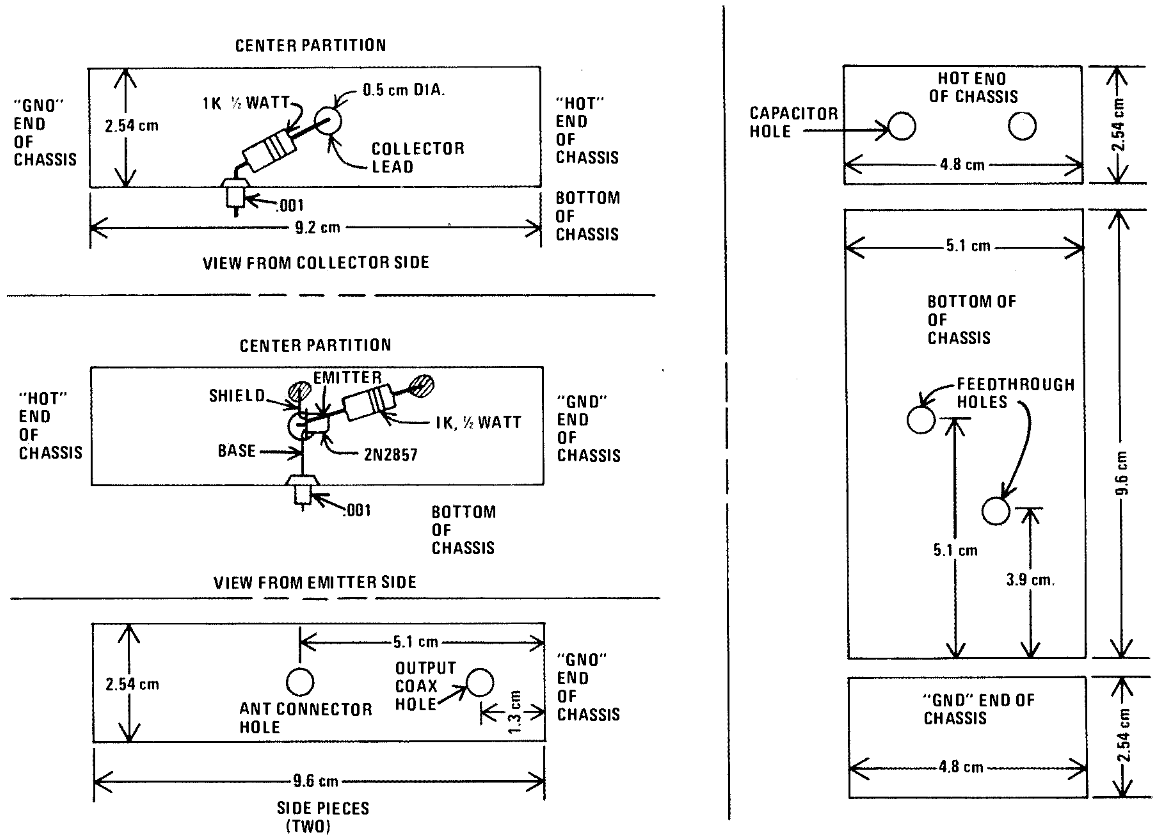


Fig. 2. Construction details and dimensions.

mitter. Other types of silicon NPN UHF transistors such as the 2N3839 may be used in place of the 2N2857.

Construction

The first step in construction is to cut out the six parts of the chassis as indicated in Fig. 2. The use of epoxy PC board results in construction that is much stronger or lighter, and is easier to work with, than in the case where copper or brass sheet is used. The PC board may be either single or double clad. It should be good quality material such as epoxy to prevent peeling when heated.

Figure 2 shows two views of the center partition, one from each side to show circuit construction details. One view is shown of both the side pieces, which are different. One hole only is drilled in each piece. The size of the hole for the antenna jack will depend on the type of connector used. RCA jacks are used almost universally in all receiver strips. The output connection from the preamplifier is a short length of RG 58 with an RCA plug on the end.

The pieces of board should be cleaned to facilitate soldering after they are cut out. Steel wool will do a good job here.

The center partition should be soldered to the bottom board first. Spot solder it together with two small blobs of solder so that its position may be adjusted if it is placed incorrectly the first time. Using a large soldering iron or gun, run a smooth bead of solder along the joint. The joint will be permanent after the entire length is soldered, and will be very difficult to remove. The hot and gnd ends of the chassis are added next in the same manner. The structure now should be quite sturdy, and at this point the internal circuitry may be added.

Mount feedthrough bypass capacitors in the holes in the bottom plate. Bend the leads of the transistor out axially from the bottom of the case, and solder the shield lead to the center partition so that the collector lead extends through the hole in the partition. The base lead will connect to the feedthrough capacitor on the bottom plate. Next

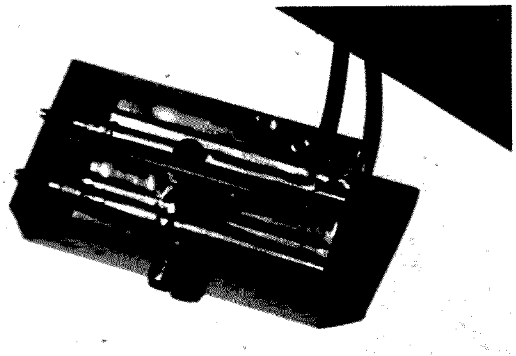
add the 1K resistors on opposite sides of the partition to the two free transistor leads as shown in Fig. 2. Keep the leads as short as possible.

The tuned circuits are added next. L1 and L2 are made from ¼ in. diameter copper tubing and should be 8.6 cm long, including the length of the capacitor. Many types of capacitors may be used in this circuit, but they should have a maximum of about two picofarads when at minimum capacitance. Ten picofarad capacitors peak near the minimum capacitance end of their range. If a piston type capacitor is used, the capacitor is mounted first and the tubing is cut to fit from the capacitor to the end of the chassis. The length of the coil is not extremely important since the capacitance may be varied. If another type capacitor is used, the coil tubing is soldered to the end of the chassis first. This is strong enough to support the capacitor while it is soldered from the end of the coil to ground by its leads. The hole in the end of the chassis is now used for access to the capacitor for tuning. Be sure to put the rotor lead of the capacitor to ground so that the tuning tool will not detune the circuit when it is touched. L1 is tapped at 5 cm from the ground end, and L2 is tapped at 5 cm for the collector, and one half inch for the output coax lead.

With the coils in place the 800 pF capacitors can be added. These were small disc ceramics stripped from an old TV receiver chassis. The critical point with these capacitors is size – the smaller the better.

The two sides can be added now that the center circuitry is completed. It is easier to mount the input jack after the side panel is mounted to make soldering the long joint easier. On the output side it may be easier to solder the coax braid on first, since this may be difficult. The coax is passed through the hole with about 0.6 cm of braid exposed. The braid is spread out axially and soldered to the chassis. The insulation is stripped before mounting the panel and soldered after the side panel is secured. Be sure to run a smooth bead of solder around all corner joints. The internal wiring is now completed.

The 2.5K and 4.7K resistors are mounted externally under the bottom plate. It is necessary to drill a hole through the bottom



Top veiw of the 450MHz preamp. The chassis is made of epoxy PC board for ease in construction.

to ground the 2.5K resistor. A top cover can be made by soldering bolts (with the heads cut off) around the edges and center of the top of the chassis. Poke the extended bolts through a piece of paper to make a template for drilling holes in the cover. As a final step the inside of the chassis can be cleaned with a solvent such as toluene, acetone, or lacquer thinner, and a stiff acid brush. Do not use ordinary rubbing alcohol; it will leave a residue. The cleaning will remove the rosin and any solder balls or metal filings that may be sticking to the rosin.

Operation

Just plug it in and tune it up. The amplifier should pull about 1.5 mA at 9V. The voltage may be obtained from a dropping resistor and a 9V zener diode, or 6V could be obtained from a 6V tube filament in a series connected 12V filament receiver system. If the preamplifier is mounted externally to the receiver it may be powered by a 6V lantern battery left permanently connected.

It may be necessary to reduce the value of the 2.5K resistor if the amplifier pulls more than about 1.5 mA. As the bias is increased, the current is increased; this will increase gain, but will also increase noise generated by the transistor. As bias is increased, instability may result and bias will have to be reduced by making the 2.5K resistor smaller. Instability is discovered by the appearance of spurious signals, or the capacitors may tune for a peak at more than one point.

The diodes may now be added and the preamplifier rechecked to determine whether performance has been affected. The entire front end of the receiver should now be retuned. The input circuit of the preamplifier should tune broadly and the collector circuit should tune rather sharply. The tuning should be smooth and within the range of the capacitors.

The preamplifier may not work well in duplex operation since it is susceptible to cross modulation problems typical to bipolar transistors, and the single input tuned circuit does not provide much selectivity.

Results

The amount of receiver performance was indicated in a weak signal area where the remote transmitter signal was chopping in and out of the mobile receiver in a moving vehicle. Addition of the preamplifier under the same conditions reduced the deep chop to popping, eliminating the dead spots. Even with severe popping an FM signal is still intelligible, but if it chops out completely part of the signal is lost.

This simple preamplifier turned out to be very easy to construct and represented so great an improvement in system performance it was hard to understand why it was not built sooner. Everybody should have one!

. . .WB6BIH

TESTING ROOF MOUNTED WHIP ANTENNAS

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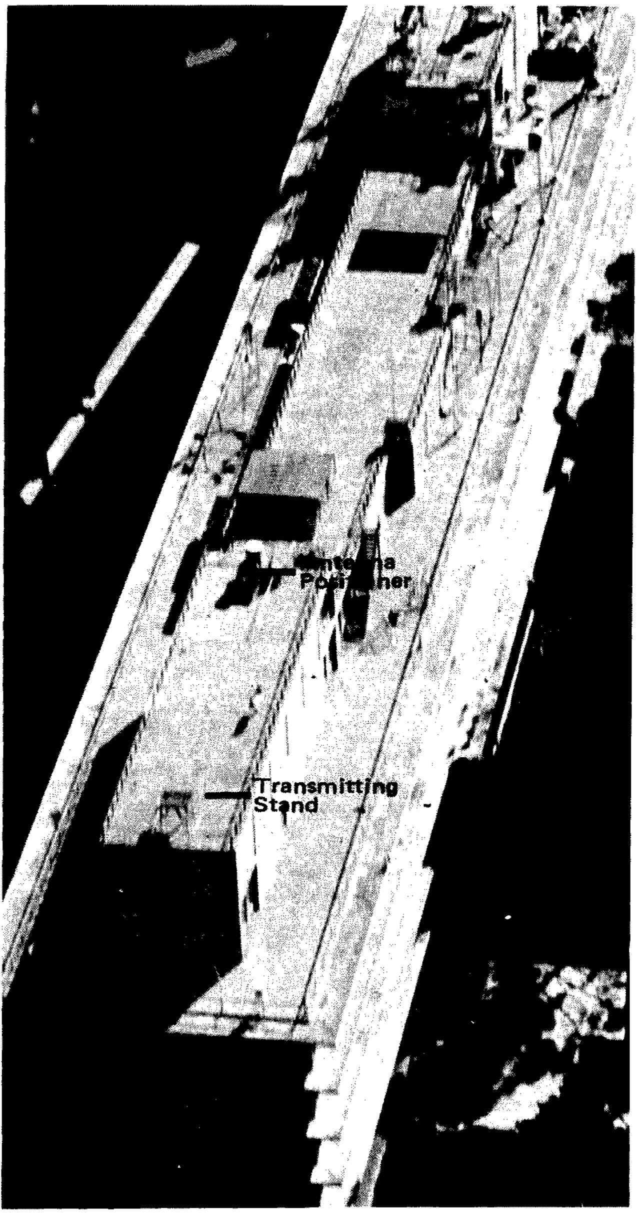


Antenna test range at the U.S. Naval Postgraduate School in Monterey, California.

The stimulus for this article has come from the lack of actual test results and the compounding of misinformation regarding mobile VHF whip antennas. There are many books and papers published that go into the theory of antenna performance, but none have been found that show the actual pattern and gain in addition to valid comparisons between the different types.

This article presents actual test results of three basic mobile VHF whip antennas. The three antennas are the one-quarter wave whip, a base loaded one-half wave "gain" antenna that most two meter FM'ers gradu-

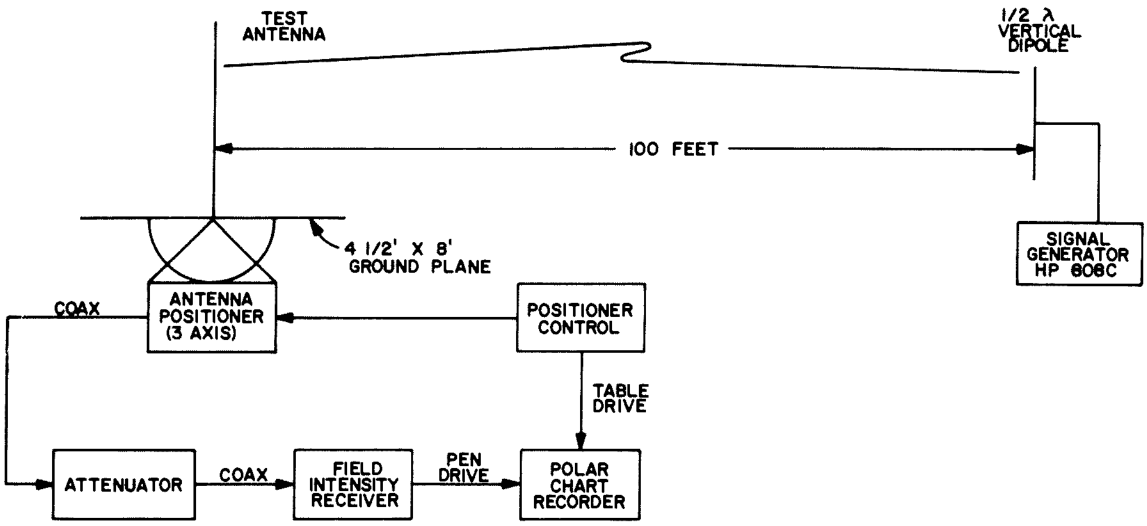
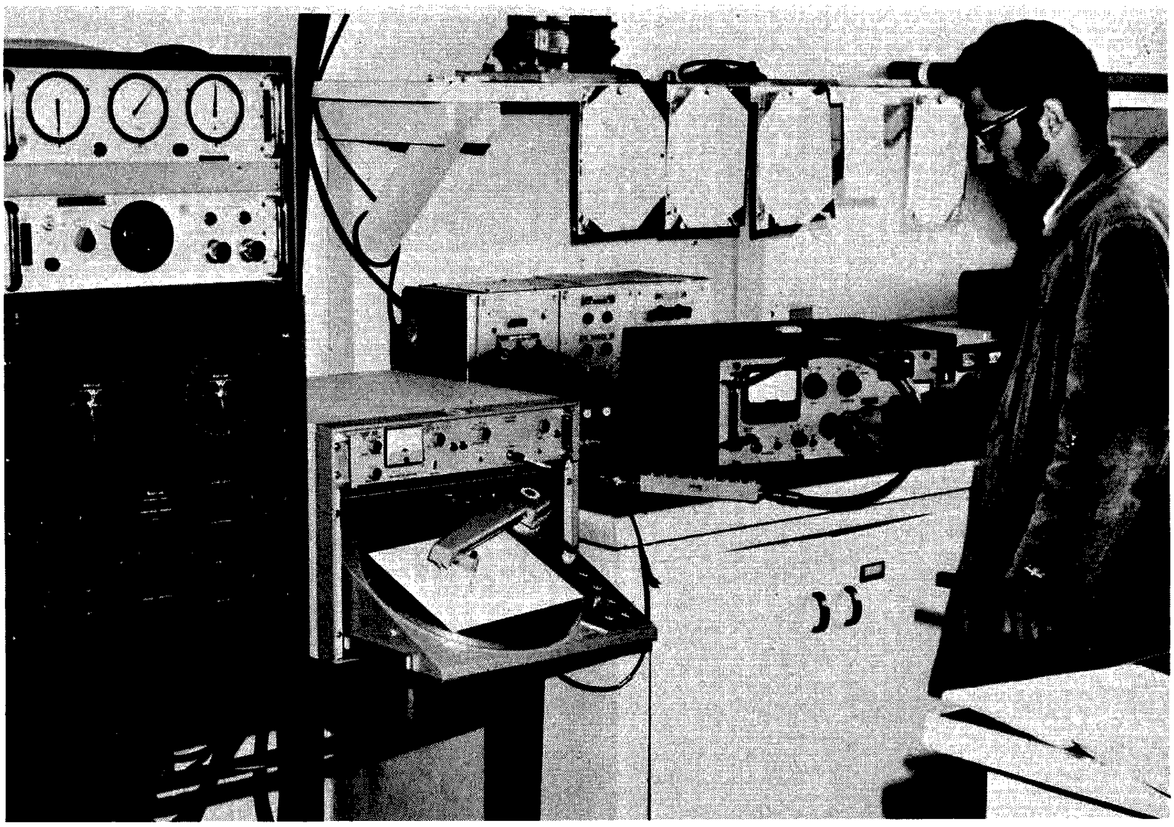


Fig. 1. Functional block diagram of test range.



Positioner controller, polar chart receiver, attenuator, field strength receiver.

ate to, and a balanced end-fed one-half wave "J" antenna. Antenna talk among professionals as well as amateurs is a highly emotional topic, due to all the different misconceptions that have been proliferated.

By measuring an antenna pattern in a realistic situation, one gets a realistic pattern and not an ideal pattern. Great care must be exercised in making antenna measurements to avoid mistaken results. To make meaningful antenna measurements, certain parameters have to be kept constant, like path distance, the receiver and transmitter frequency and gain settings and the losses in the test antenna feedline system. All of these details and more were taken care of by months of hard work, anguish, and finally success.

Test Setup

The test range is on the roof of the U.S. Naval Postgraduate School in Monterey, California. To simulate the roof of a car or station wagon, a 140 x 250 cm sheet of sixteen gauge brass was attached to the three-axis antenna positioner. The equipment hook-up is shown in the block diagram and the photos.

The Coordinate System

The coordinate system is shown in Fig. 2. The antennas under test are oriented along the Z axis when the ground plane is parallel to the earth. The X Y plane is in the ground plane when it is parallel to the earth, the X

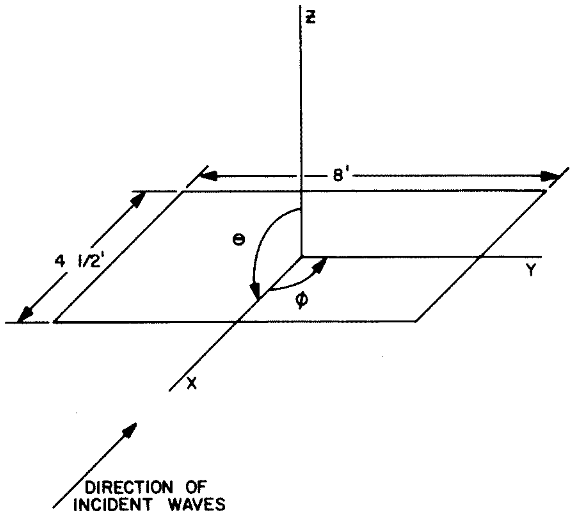


Fig. 2. Coordinate system.

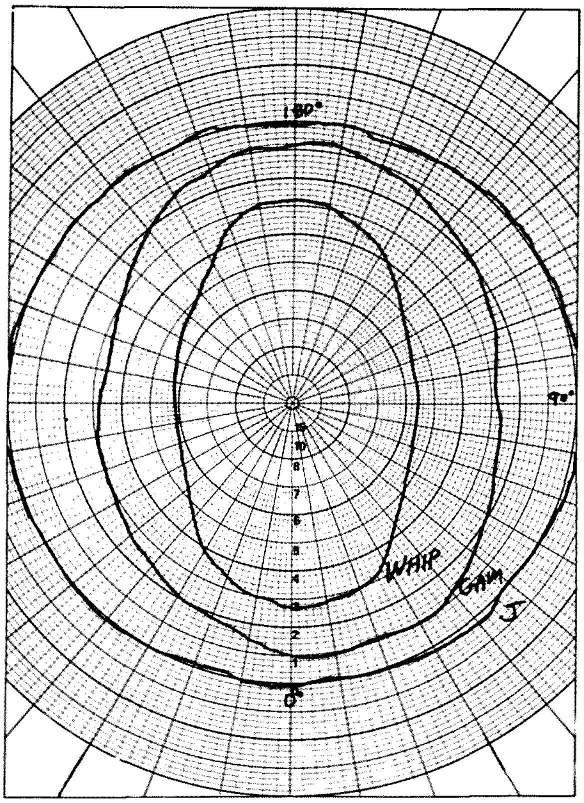


Fig. 3. Horizontal patterns. θ is held constant at 90°, while φ varies from 0° to 360°.

axis is in the direction of the transmitting antenna.

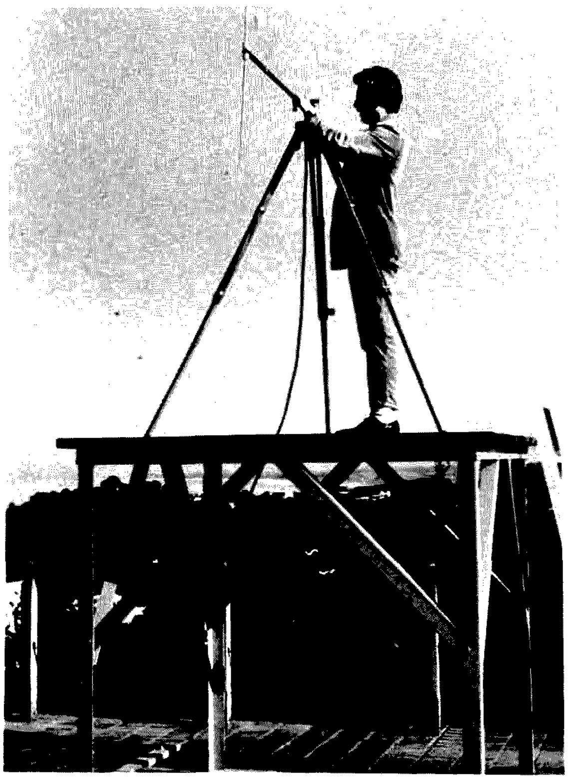
The azimuth or horizontal angles of rotation, ϕ, is measured from the X axis in degrees. The elevation on vertical angles, θ is measured from the Z axis downward toward the X Y plane. An example of the coordinate system: $\theta = 90^\circ$ and $\phi = 0^\circ$ references the ground plane parallel to the earth with the received signal arriving along the X axis or perpendicular to the long side of the ground plane.

Antenna Adjustment

The "J" antenna is basically an end fed one-half wave radiator. Only the upper one-half wave length of the antenna radiates, since the one-quarter wave matching section has balanced transmission line currents on it. A 4:1 one-half wave balun made from 50Ω coax is used to feed the 200Ω feed point impedance. The one-quarter wave whip was cut to resonance and connected directly into a bulkhead coax fitting on the ground plane. The one-half wave base tuned antenna (a Gam model TU-2) was also trimmed for minimum swr. The swr of all three whips was checked over a 2 MHz band centered on 146 MHz and found to be less than 1.5:1. The reference dipole used was a commercially made, tunable, standard antenna used for field strength measurements. Preliminary measurements indicated that the "J" antenna was the most sensitive of the three, therefore it was used as the zero dB reference in the pattern measurements. The receiver and thepolar chart recorder were checked using a calibrated attenuator to ascertain their ability to accurately track the signal strength.

Test Results

First, all the antennas were rotated about the Z axis giving an azimuth on horizontal plane pattern. Referring to Fig. 3, it can be seen that the horizontal pattern for the "J" is within a ½ dB of being circular. The one-half wave vertical had an elliptical pattern. At $\phi = 0^\circ$ and 180°, (along the short dimension of the ground plane) the one-half wave vertical was 1 dB down, but at 90° and 270°, (the long dimension) it was almost 3 dB down! For the quarter-wave whip, the elliptical pattern starts to approach a rec-



Reference dipole on transmitting platform.

½λ Gam mounted-on ground plane.

tangle. At ϕ = 0° and 180°, the pattern of the whip was down 3 dB from the "J" and at 90° and 270° it was down about 7 dB. Notice how each succeeding antenna becomes more and more dependant on the ground plane!

Next ϕ was kept constant at 0°, 45°, and 90° and a portion of an elevation plane pattern was obtained by tilting the ground plane from horizontal. The antennas and the ground plane were rotated from 0° to 90° in the θ direction with ϕ held at 0°. Looking at Fig. 4, the "J" has its maximum lobe directly on the horizon in this direction. The half-wave vertical has a maximum lobe which is 13° up from the horizon in this direction. The quarter-wave whip has an almost circular pattern from θ = 90° to 65°. The response of the quarter-wave whip varies about 3 dB from maximum to minimum in the θ direction, whereas the response of the "J" varies about 15 dB from maximum to minimum in the ϕ = 0 direction.

As would be expected by this time, elevation cuts in the ϕ = 90° direction show an even more pronounced difference. Look-

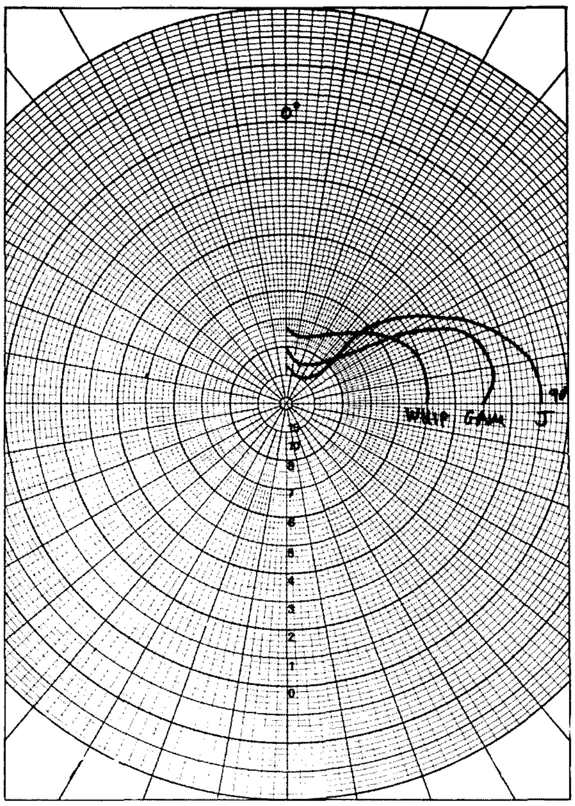


Fig. 4. Vertical cuts. Here ϕ is constant at 0° while θ is changed from 0° to 90°.

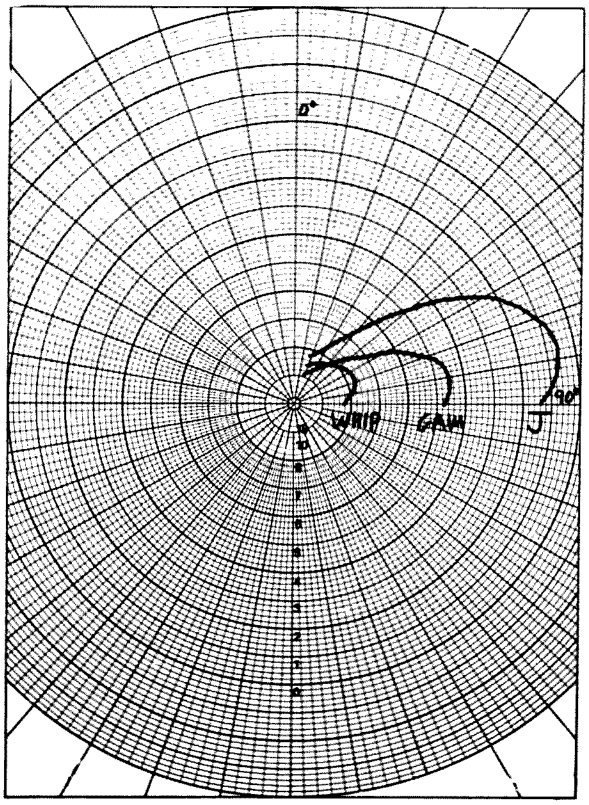


Fig. 5. Vertical cuts. ϕ is constant at 90°, θ varies from 0° to 90°.

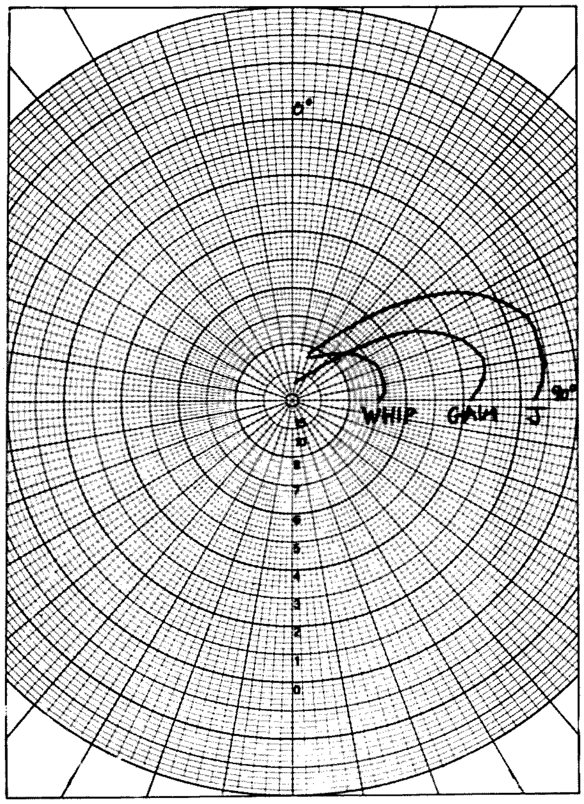
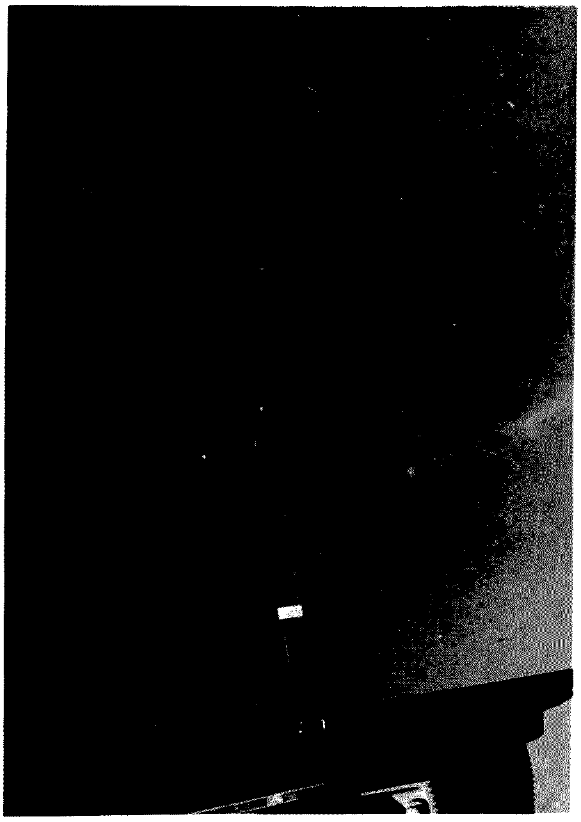


Fig. 6. Vertical cuts. Here ϕ = 45°, while θ varies from 0° to 90°.

ing at Fig. 5, where $\phi = 90°$, it can be seen that the presence of the ground plane actually degrades the "J" performance by lifting the major lobe about 17° above the horizon! The direction of the major lobe of the half-wave vertical remains the same (about 10° – 15°), but the overall response in that direction is down 2 dB from the maximum. The quarter-wave whip begins to show a bit more directivity with a lobe up about 25° from the horizontal.

The θ or vertical patterns in the $\phi = 45°$ plane (Fig. 6) appear half-way between the extremes found in Figs. 4 and 5, and by symmetry can be reasonably reflected through the Z axis to give an accurate three-dimensional field strength pattern of these roof mounted antennas.

Since the "J" had the most symmetrical pattern and had the least dependency on the ground plane, it was compared with the reference dipole to arrive at a gain figure. The reference dipole major lobe field strength was compared to the "J's," using the same cable and connectors. This orientation is with $\theta = 90°$ and $\phi = 0°$. Negligible differences were found between the "J" and



"J" mounted to the ground plane.

the dipole. By probing the incident fields over the area in front of the ground plane with the dipole and the "J," we found less than a ½ dB fluctuation in signal strength, indicating that reflections from surrounding objects were not sufficient to cause differences in the patterns from one antenna to the next. This means that the "J" can be considered to be a reference vertical dipole.

These results aroused a considerable amount of discussion in our local repeater group! In an attempt to keep from losing friends who owned half-wave Gams and quarter-wave Ground Planes, an attempt was made to find a set of conditions where the Gam and quarter-wave Ground Plane approached "specs." A classic quarter-wave ground plane was constructed using four drooping wires for the ground plane and the quarter-wave vertical radiator. This new ground plane antenna was mounted on a wooden pole well away from other metal objects (about 10 ft above the antenna positioner). Curiosity over the effect of radials on the horizontal pattern prompted a quick test. Figure 7 shows the results of the horizontal pattern for the ground plane.

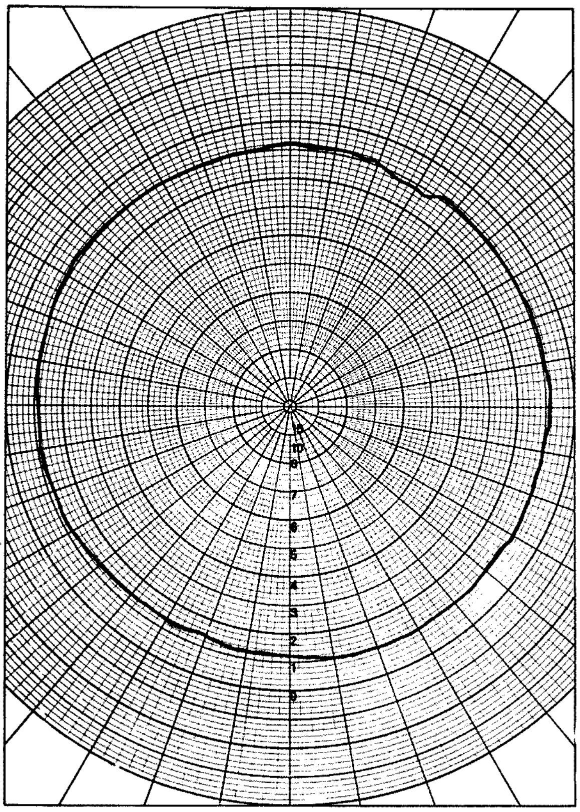


Fig. 7. Horizontal pattern for ¼λ whip on a stick whip with radials.

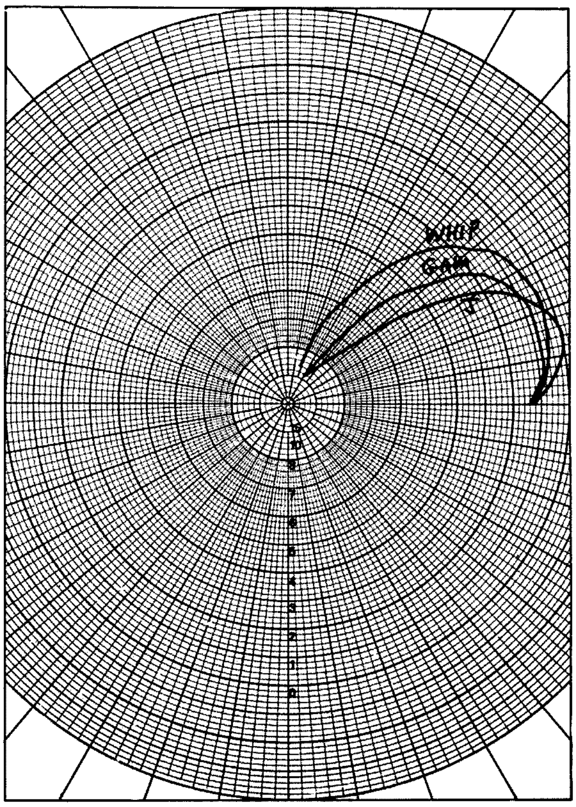


Fig. 8. Free space vertical patterns.

Delight followed the completion of such a smooth pattern! Next, the vertical patterns were compared in Fig. 8. The gain on the horizon for all three was essentially the same when they were in a "free space" condition. At best, all three antennas show the same gain as a vertical dipole.

Conclusion

We have shown that the effects of a nonresonant ground plane, such as a car roof, can be disastrous for antennas that "need" a ground plane to operate and can spoil the patterns of antennas that don't need ground planes for impedance matching. Further speculation is left to the reader as to just exactly how high above the nonresonant ground plane one would need to place a quarter-wave whip and the half-wave vertical, but I'm sure someone will become curious enough to try it. Until then, it would be unwise to believe what someone speculates, or we will be in the same fix we all were in before this article was written!

Special thanks are due to Dick Adler WA6KPF, who helped with the measurements and the writeup.

...WB6HYD

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LED READOUT CRYSTAL SWITCH

This modification enables the transmit and receive pair you are using to be directly read via diode matrices and LED readouts.

The search for something distinctive is nowhere more apparent than among ham builders. The latest state-of-the-art circuitry is constantly employed to produce electronics far surpassing the commercial variety. An even larger group of hams is perennially modifying their commercial equipment to improve its performance or convenience. I have written this to cater to those who desire more than is available commercially.

A dial readout is described here that was designed for displaying FM crystal channels, but which can be made applicable to many detented switch schemes. It uses diode matrixing and Light Emitting Diode (LED) readout, for a minimum of current draw and a maximum of flexibility and reliability.

The readout unit itself (Fig. 1) is constructed on a one-sided glass epoxy printed circuit board. The copper is etched into the seven segment pattern using standard printed circuit techniques. Either thin tape or liquid resist may be used for the pattern. Size is dependent on the space availability in the individual rig. Compartments are then constructed using flashing copper or metal claimed (recycled!) from a "tin" can. The can must be tin plated steel and not aluminum, as it is too difficult to solder to aluminum. A child's magnet will easily separate the steel from the non-ferrous metal if you are not sure. An LED is placed in each compartment and secured with a glob of silicon rubber sealant, such as Silastic or RTV. The chambers are then sealed by soldering on a metal top. This shields the LED from the effects of rf, and due to the long life of an LED there should be no need to open the compartment, once sealed. The use of the glass epoxy board is recommended due to the translucency and stability of the material.

Alternatively, slots could be cut in the panel of the rig with a saw or nibbling tool, and thin plastic frosted with steel wool placed behind the panel (Fig. 2). Such plastic may be a piece of acetate used for wallet photo compartments or notebook picture protectors. To frost, rub a fine grade of steel wool over the plastic until it becomes uniformly etched with fine scratches. Mount the plastic (with the frosted side in) on the outside of the unit. The slots will then be visible only when illuminated, as is the case with the printed circuit board, and a more distinctive, less homebrew look will result. Compartments here can be made with either metal or plastic, glued to the rear of the panel. If

available, of course, a standard seven segment commercial LED readout could be used.

The matrix is a seven diode maximum per character circuit that uses from two to seven diodes to form each digit. The matrix desired is selected by an additional wafer on the transmit and receive crystal switch. A single-pole switch is used, with as many positions as needed for the number of channels to be covered. Each switch position is connected to two matrix busses in order to provide two digits. Figure 3 is a sample two digit readout set up for 76 and 94. Diodes are placed in the matrix in accordance with the scheme shown in Fig. 4 to provide any of the desired digits. If a decimal point is needed, another LED with

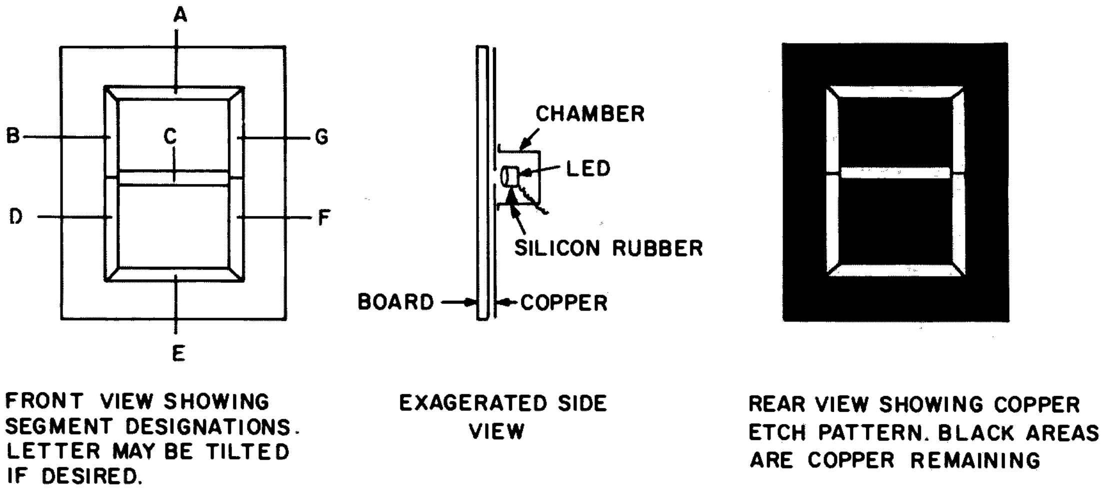

Fig. 1. Construction details of the readout from single sided glass epoxy board.

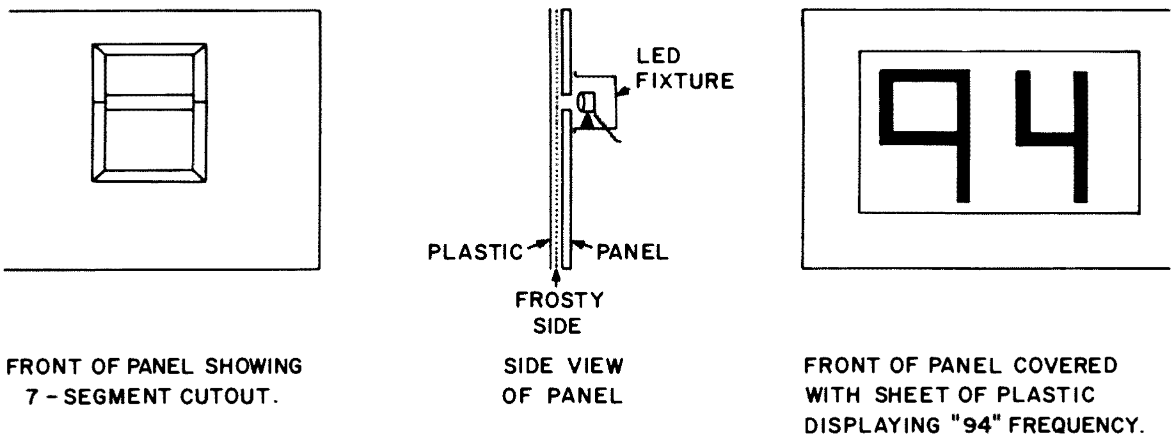

Fig. 2. Alternate construction technique using panel cutouts and frosted plastic.

its resistor could be connected directly to the supply to provide that function.

A sample schematic is shown in Fig. 5. Here three transmit and receive frequencies are provided for: transmit frequencies are 16, 28 and 94; receive frequencies are 76, 88 and 94. Double ended boards are used for each pair of readouts. A large board with four matrices could easily be used.

While printed circuit technique with double sided boards is undoubtedly the most convenient way to make the matrix, perforated board can be used with flea clips and bus wires. A hybrid board, using one set of etched conductors and one set of bus wires may be the most satisfactory solution to many builders. Figure 6 illustrates the various types of construction.

The entire unit is powered from a 12 volt supply and is directly applicable to mobile rigs. For base station use, a simple voltage

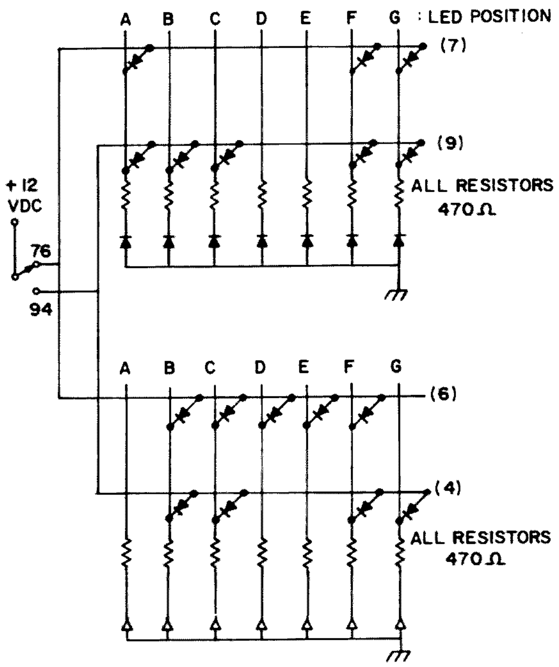

Fig. 3. Schematic of a simple 76-94 switch.

SEGMENT

DIGIT	A	B	C	D	E	F	G
1						X	X
2	X		X	X	X		X
3	X		X		X	X	X
4		X	X			X	X
5	X	X	X		X	X	
6		X	X	X	X	X	
7	X					X	X
8	X	X	X	X	X	X	X
9	X	X	X			X	X
0	X	X		X	X	X	X

X = DIODE NEEDED

Fig. 4. Encoding scheme for the matrix. Referring back to Fig. 3: To display 76, diodes are connected from the 76 position on the switch to the A, F, and G busses for the number 7, and the B, C, D, E and F busses for the number 6.

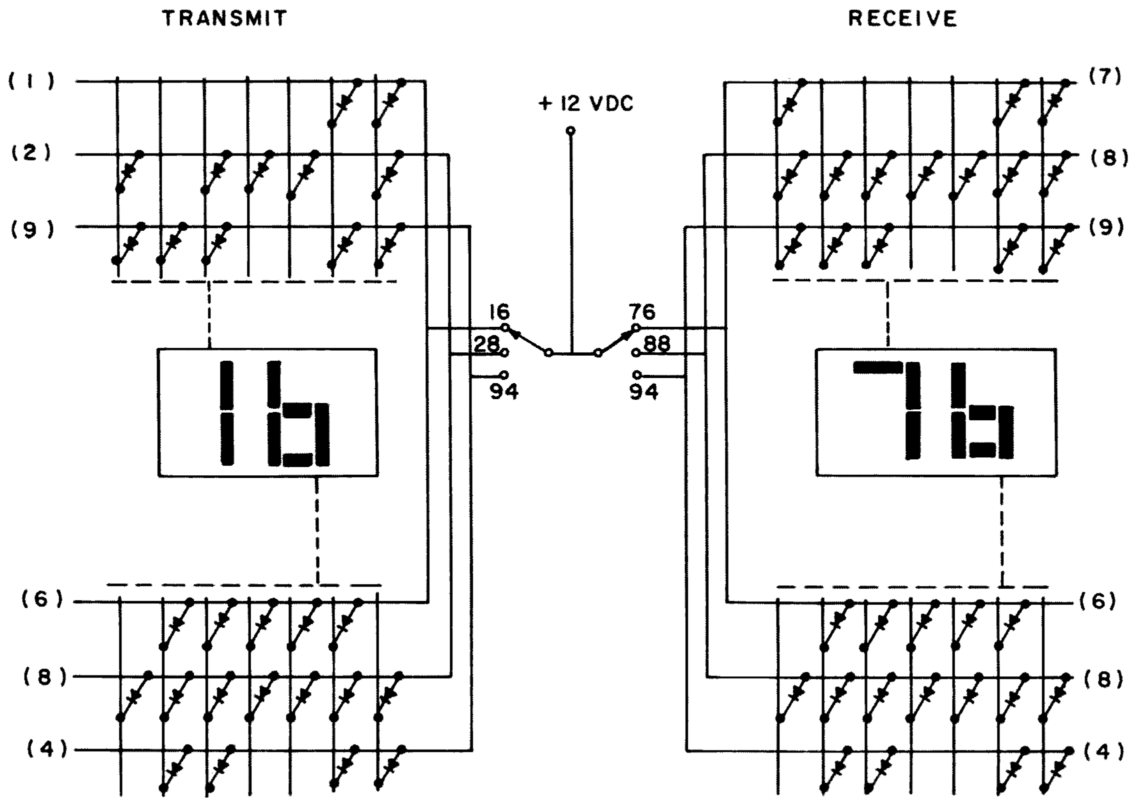

Fig. 5. Typical circuit that will display 16-76, 28-88, and 94-94.

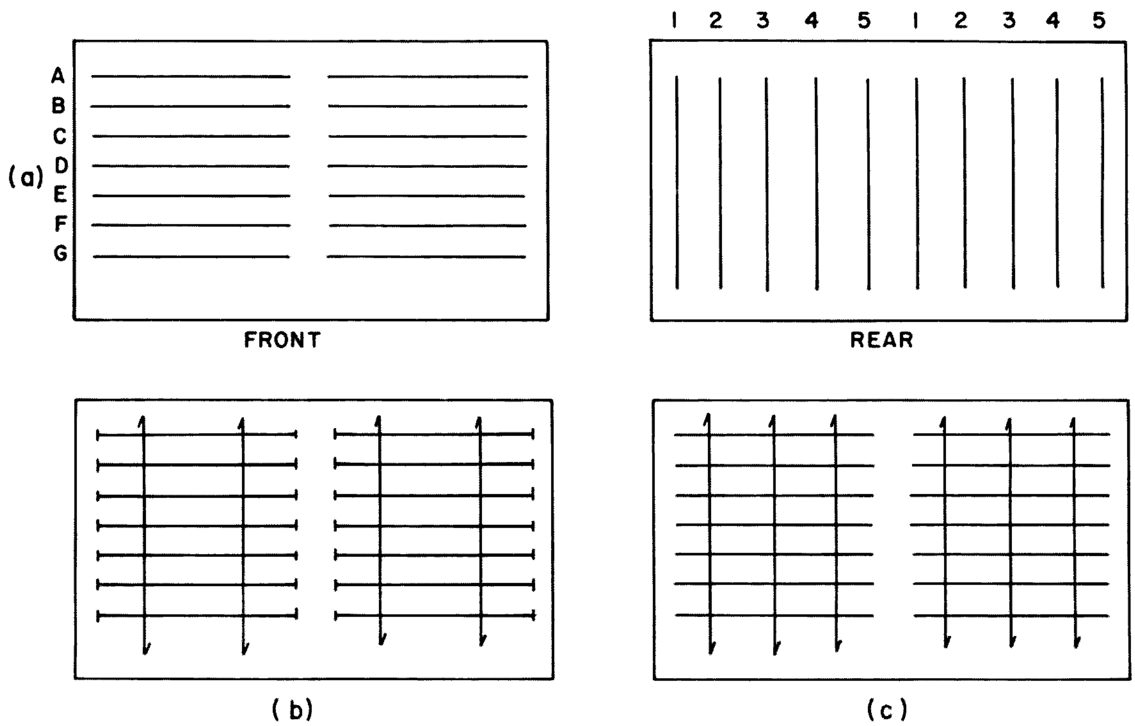

Fig. 6. Types of matrix construction. (a) PC double sided board etched for 5 frequencies, 2 digit readout. (b) Perf board with flea clips for 2 frequencies. (c) Perforated PC board with etched segment busses and wire individual digit busses.

divider from B+, or a tap onto a 12 volt supply can be used. Voltage is not critical, and anything from 10–15V dc will work.

Parts for this setup are not the most critical in the world. The LED's can be bought from several companies, among them Poly-Paks, for around one dollar each. The diodes are the common type that can be had from many sources for around ten for a dollar. Boards, resistors, etc., are stock items.

Although this is a simple scheme, it works as well as much more complicated ones. Seven segment decoder/drivers are available as integrated circuits that will take the place of the matrix used here, but their cost is prohibitive. It is felt that the techniques used here allow a distinctive look to be imparted to many projects at a level most builders are able to afford. The seven segment readout and matrix can be applied to items besides FM gear: receiver bandswitches, clocks, and anywhere else a highly legible data display is needed at a minimum of cost.

...WA3AJR/3

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VOLTAGE LIMIT SENSOR

A sensor that continuously monitors your mobile's electrical system and indicates voltage variance outside a predescribed range.

The voltage limit sensor (VLS) is a compact, self-contained go, no-go indicator which tells at a glance if the voltage in an automobile or boat electrical system is satisfactory. Many of the latest state-of-the-art electronics equipment have incorporated into them various sensors which continuously monitor test points. Whenever one of these test points deviates outside prescribed limits, a warning light or indicator of some type alerts the operator. In the go, no-go variety of indicators, similar to the oil pressure, generator and temperature lights on automobiles, only a critical condition will necessitate some action on the part of the human operator. The low cost sensor described in this article provides an alerting indicator if the voltage in the electrical system falls outside safe limits.

Theory of Operation

Operation of the sensor is very straightforward. Referring to the schematic diagram, Fig. 1., the voltage input provides both the sense voltage and the supply voltage needed to operate the VLS.

The undervoltage part of the VLS consists of Q1, Q2, DS1, and D1 along with three resistors R1, R2, and R3. When the

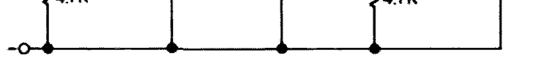

Fig. 1. Parts List: Q1, Q2, Q3 – Motorola MPS 3704; D1 – Motorola IN 5243B, 13V ± 5% zener diode; D2 – Motorola IN 5245B, 15V ± 5% zener diode; PL1 – Dialco MS 25256 Pilot Lamp Assembly (Amber Lens) with #330 Bulb (T-1 ¾, 14V at 80 mA); PL2 – Dialco MS 25256 Pilot Lamp Assembly (Red Lens) with #330 Bulb (T-1 ¾. 14V at 80 mA); R1, R3, R4 – 4.7 KΩ, ¼W; R2, R5 – 470Ω, ¼W; R6 – 27Ω, ½W; misc. hardware – CU 2101A minibox, terminal strips, rubber grommet, etc.

input voltage is less than the breakdown voltage of D1, transistor Q1 is turned off. This in turn allows the current flowing through Q1's collector load resistor, R3, to flow into the base of Q2. This causes Q2 to go into saturation acting like a switch to light the amber indicator, DS1. As the input voltage goes through the zener breakdown point, current begins flowing into the base of Q1. When Q1 has gone into saturation, no base current is available for Q2 which turns off. Indicator, DS1, also goes out since Q2 is cut off. Resistor R1 assures a sharp turn on of Q1 and also provides a path for collector leakage of Q1. R2 limits the base current into Q1 after D1 is conducting.

The overvoltage part of the VLS consists of Q3, DS2, D2 and resistors R4, R5, and R6. Q3 is cut off until the input voltage exceeds the zener breakdown of D2. At this point, base current flows into Q3 turning on the indicator, DS2. R4 and R5 serve similar functions as R1 and R2 described above. R6 is a current limiting resistor so DS2 does not burn out for the higher input voltages.

Design Criteria and Construction

Silicon transistors are used to assure stable operation over a wide range of temperatures. The transistors, Q1, Q2 and Q3 were chosen to have high beta of 100 to 300, and a high collector current rating of at least 100 mA. Voltage breakdown can be 20–25V or more. A collector power dissipation rating of 300 mW or greater is also desirable.

The voltage at which an automobile operates its primary low voltage system is a function of temperature. For example, a typical GM product will have a range from 13.5V at 150°F to 15.2V at 0°F. The combination of zener diodes, D1 and D2, plus the small base to emitter voltage drops of Q1 and Q3 were chosen such that any voltage less than 13.5V would light the amber indicator and any voltage more than 15.2V would light the red indicator. The 5% zener diodes assure an accurate turn on and turn off without any adjustments.

Since the VLS detects a voltage falling outside these defined limits, it was felt that tracking as a function of battery temperature was not justified. An elaborate temperature sensing circuit was deemed unnecessary and beyond the basic requirements of the VLS.

The circuit was constructed in a small Bud Minibox without crowding. The two pilot lamp indicators are mounted in one end and a rubber grommet in the other end for the two wires. If the VLS is to be used on a negative ground system and the unit is to be securely fastened to the metal ground of the automobile or boat, then the negative lead can be grounded to the case internally and only one wire, the positive lead, brought out of the unit. No special wiring precautions are necessary; however, if sockets are not used for the transistor it is recommended that a heatsink be used on the leads during the soldering operation. This will prevent the possibility of damage to the transistors from excessive heat.

Checkout and Installation

Since the VLS draws a negligible amount of current during normal operation and only 80 mA during the time an indicator is on, power can be obtained from almost any point in the low voltage electrical system. However, it should be switched on and off with normal ignition and accessories since with just 12V input, the amber indicator will be on drawing continuous current.

During operation at an ambient temperature of about 75°F where the voltage input will be about 14.2V or so, it is possible to use a 1.5V dry cell battery placed in series with the positive lead to check the VLS. With the 1.5V battery positive terminal connected to the VLS (battery voltage adding), the red indicator should light. With the 1.5V battery negative terminal connected to the VLS (battery voltage subtracting), the amber indicator should light. This test will generally work unless the automobile low voltage is not adjusted properly or the ambient temperature is very high or very low. In these cases, a bench-type variable-voltage power supply could be used for final checkout.

The voltage limit sensor will monitor your 12V battery and charging system alerting you only to potential unsafe conditions not indicated on the usual idiot light.

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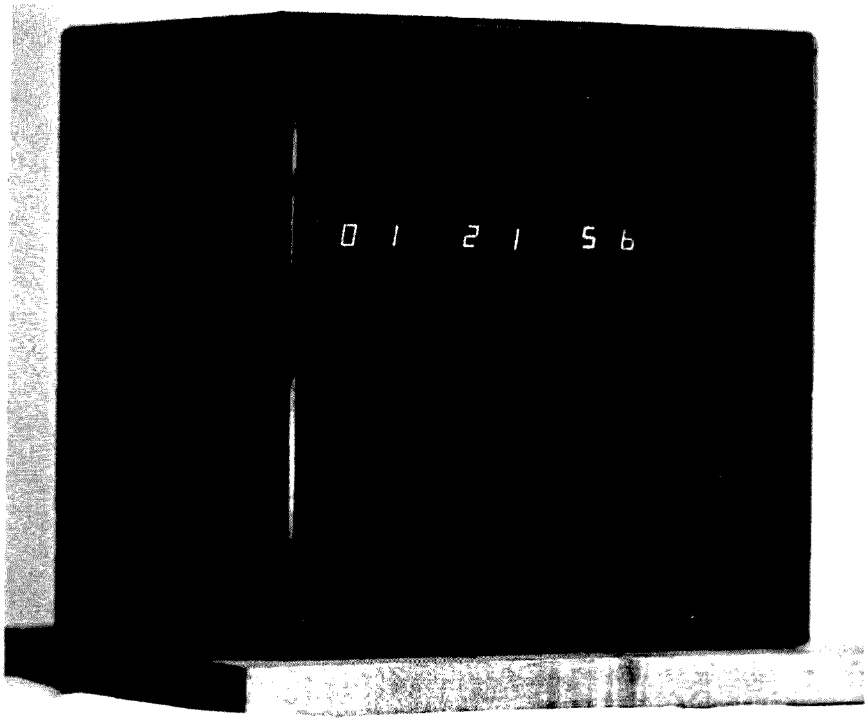

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Smoky plastic case gives a neat finished appearance to the clock and hides its innards.

BUILD A DIGITAL CLOCK WITH 19 INEXPENSIVE ICS

The normal 60 Hz line current can be tricked into counting time with this simple and easy to build digital clock. The clock requires only 19 standard, inexpensive TTL integrated circuits and six light emitting diode (LED) displays which are housed in a plastic box. The clock design is unique in that up-down counters are used to count hours in order to minimize the number of components that would otherwise be required in other complex counter and decoder arrangements.

Referencing timing pulses for the clock are obtained by counting each cycle on the 60 Hz line and dividing by 60. The rise and fall of the raw 60 Hz sine wave is too slow and therefore must be reshaped before applying to the TTL integrated circuits which are designed to operate at high frequencies (typically 20 MHz). Positive 60 Hz pulses are obtained from the secondary of the power transformer with a half wave rectifying diode. The pulses are clamped to approximately 2.5V by the forward voltage drop across four series diodes placed across the input of one of the Schmitt triggers in the dual NAND Schmitt trigger, Q1. The SN7413 dual NAND Schmitt trigger has the capability of producing jitter-free square wave output when triggered by slow rise time pulses as in the case of the 60 Hz line frequency. False signals due to transients on the 60 Hz line are minimized by the 1.7V minimum signal level required by the Schmitt trigger for cycling. 60 Hz square waves from the Schmitt trigger are applied to the input of the divide-by-twelve counter, Q2, which produces ten counts per second. Output from Q2 is connected to the input of the decade counter, Q3, which provides an output of one count per second. The 1 Hz timing pulses from Q3 are applied through switches SW1 and SW2 for either counting or setting the time.

When switch SW1 is in the "ON" position, the 1 Hz pulses are applied to the input of the decade counter, Q4 (seconds coun-

ter). Output pulses from Q4 are applied to the BCD-to-seven-segment decoder/driver, Q5, which drives the seven segment LED display, D1. The 0.1 Hz output signal from pin 11 of Q4 is coupled via a 2N4148 diode and a .01 μF capacitor to the input of the divide-by-six counter, Q6 (tens of second counter). Use of the series connected diode and capacitor allows the output of the seconds counter, Q4, to be isolated from the output of the decade counter, Q3, when the tens of seconds counter, Q6, is being advanced.

The tens of seconds counter, Q6, although actually connected to divide by twelve divides the output from Q4 by six twice before resetting. Only the A, B, and C outputs are used from the tens of second counter Q6 which yield a normal BCD code for counts 0 to 5 and repeats the same BCD code for counts 6 through 11 before resetting at the count of 12. If the tens of seconds counter, Q6, was connected for a true divide by six operation, the output would be in a binary code in lieu of a BCD code which is required by decoder/driver Q7. Output from Q6 is applied to the BCD-to-seven-segment decoder/driver and, also, to the inputs of three of the inverters in the Hex Inverter, Q8. Outputs from the three inverters of Q8 are applied to the triple input NAND gate Q9 which provides the f/60 signal for the minutes decade counter, Q10. The f/60 signal is thus provided from the output of Q9 when the A, B, and C outputs of Q6 simultaneously reach a logic state of one (count of 6 and 12).

Output from Q9 is coupled with a diode and capacitor as in the case of the output from the previous seconds counter, Q4, to

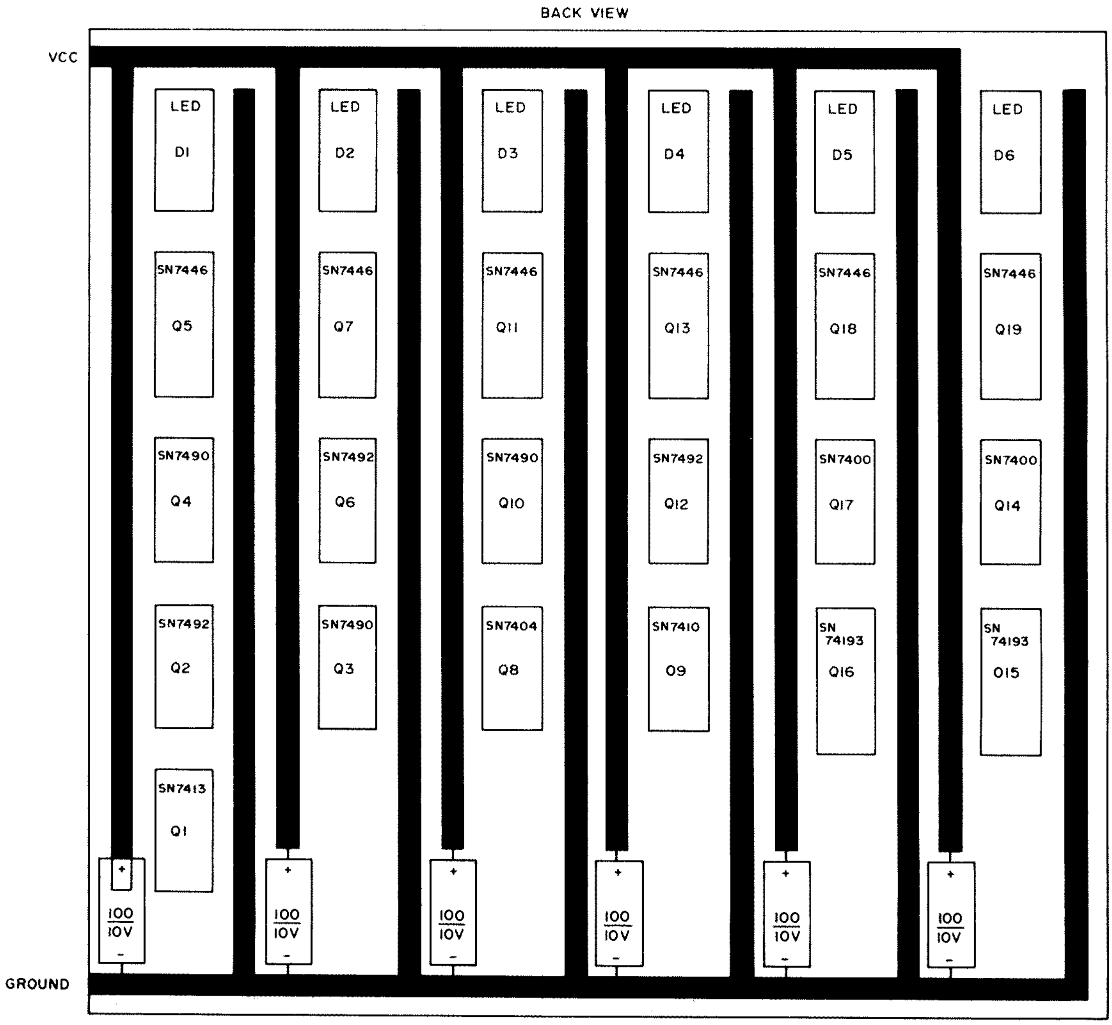
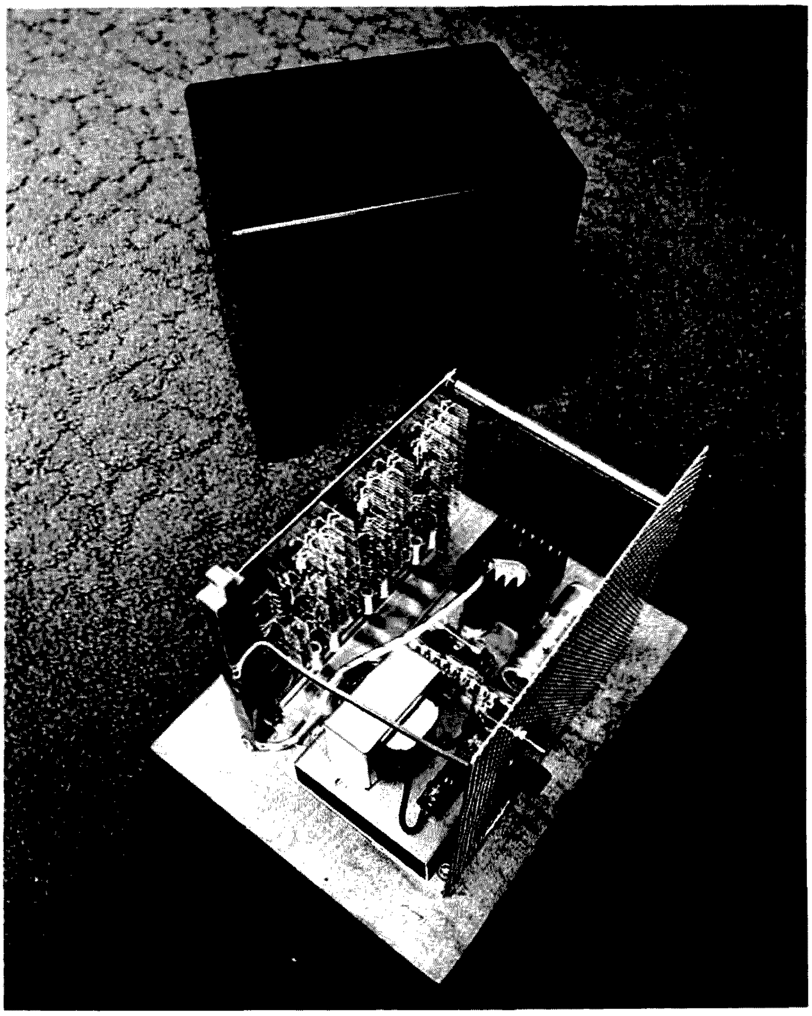


Fig. 1. Circuit board, showing the positive and ground busses running between the ICs.

provide isolation of the triple NAND gate output when the minutes counter, Q10, is advanced. A 220 pF capacitor is placed across the output of Q9 to prevent false output conditions during the time required for the four internal JK flip-flops of counter Q6 to change logic states which do not all occur simultaneously. These false output signals are suppressed by the 220 pF capacitor during the counting interval 1 to 5 and 7 to 11 and therefore are not counted by Q10 as real f/60 signals.

The f/60 output from Q9 is applied to the minutes counter, Q10, and tens of minutes counter, Q12, which function identically to the seconds and tens of seconds sections of the clock.

Counting of the hours and tens of hours is accomplished with the use of up-down counters Q15 and Q16. Using another decade counter would divide the f/3,600 output of the tens of minutes counter to a f/36,000 output, but could not directly drive a BCD-to-seven-segment decoder/driver because the tens of hours display, D5, must show 0 for nine hours and a 1 for three hours. The up-down counters Q15 and Q16 have presetable inputs which enables the output to be preset to any desired state for programmed cycling and provides a BCD output for the decoder/drivers. Counter Q15 is connected to count from 1 to 13 and then reset to 1 by the triple input NAND gate Q9 when the A, C, and D outputs of counter Q15 simultaneously reach a logic ONE state at the count of 13. The Q16 counter is connected to count from 1 to 9 and 0 to 3 alternately, resetting and loading in a 0 or 1 respectively, with the flip-flop comprised of two dual input NAND gates in Q14. Thus,



With the case removed, the digital clock still looks neat and clean. Base is stained hardwood.

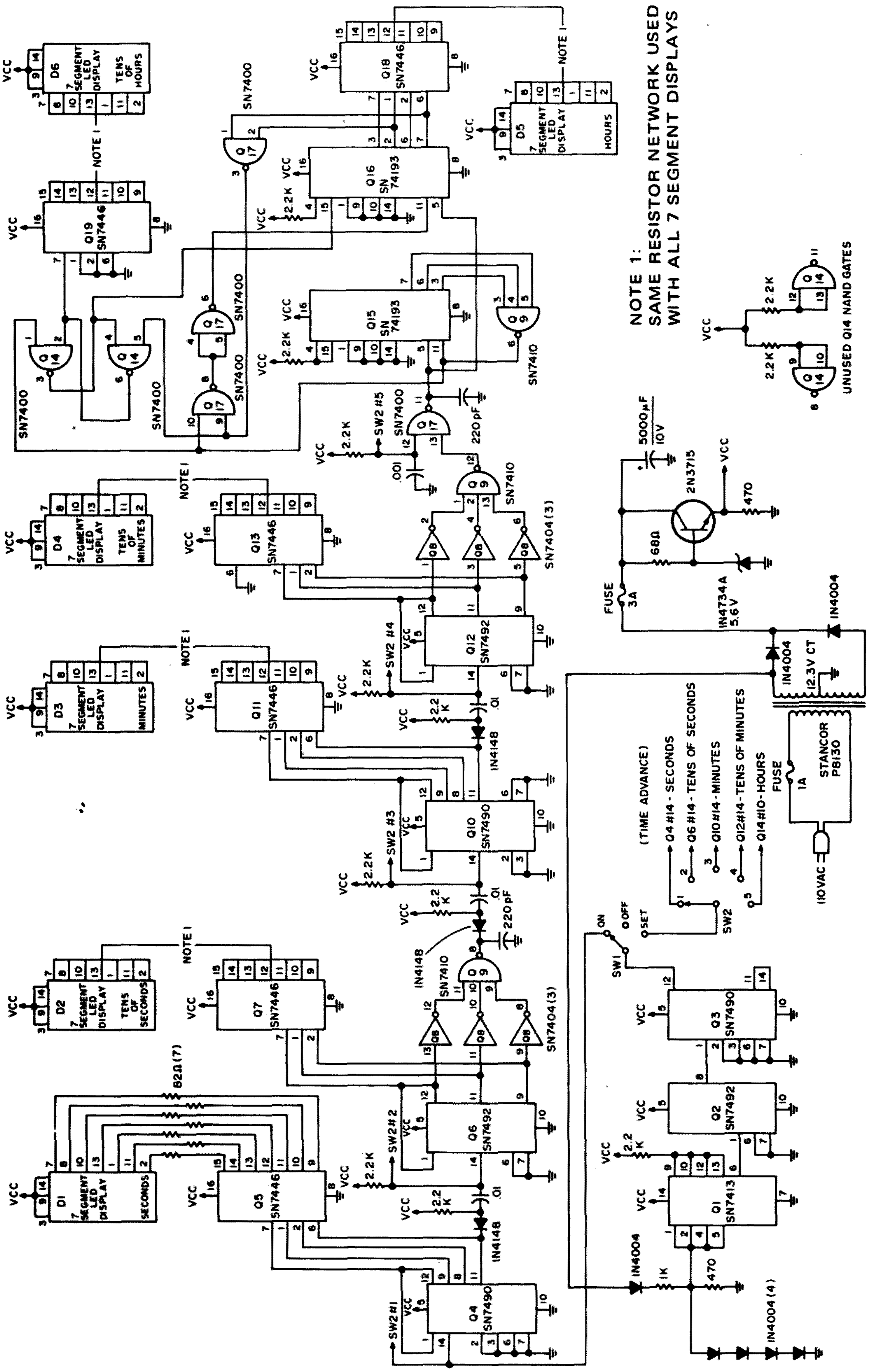


Fig. 2. Schematic of digital clock. For parts list, see next page.

PARTS LIST

Q1	Dual NAND Schmitt Trigger SN7413
Q2, 6, 12	Divide-By-Twelve Counter SN7492
Q3, 4, 10	Decade Counter SN7490
Q5, 7, 11, 13, 18, 19	BCD-To-Seven Segment Decoder/ Driver SN7446
Q8	Hex Inverter SN7404
Q9	Triple 3-Input Positive NAND Gate SN7410
Q14, 17	Quadruple 2-Input Positive NAND Gate SN7400
Q15, 16	Up-Down Counters SN74193
D1, 2, 3, 4, 5, 6	Seven-Segment LIGHT Emitting Diode Displays; Litronix Data-Lit 10 or Monsanto MAN 1.

1	5000 μF 10V electrolytic
3	.01 μF 50V ceramic
2	220 pF @ 300V, silver mica
1	.001 μF @ 500V ceramic
6	100 μF @ 10V electroyltic
1	3 amp fuse
1	1 amp fuse
1	68Ω ¼W
2	470Ω ¼W
12	2.2K, ¼W
1	1K, ¼W
42	82Ω ¼W
7	1N4004
3	1N4148
1	2N3715
1	Stancore P8130 xfmr
1	5.6V 1N4734A zener
1	Thermalloy type 6003B-2 Heat Sink
1	Phono Plug and Jack
2	Fuseholders
8	14 pin IC Sockets
17	16 pin IC Sockets
1	Alcoswitch MST-105E (SW1)
1	Centralab PA2001 (SW2)

15.2 x 15.2 cm "P" pattern, Micro-Vectorbord
17.8 x 8.9 x 2.54 cm. aluminum chassis

the hours counter Q16 is reset by either the two input NAND gate Q17 connected to the B and D outputs of Q16 when both reach a logic ONE state at the count of 10 to load in a zero, or when the Q15 counter resets at the count of 13, at which time the Q15 counter loads in a count of one. This allows the clock to count to a logic state of 13:00:00 which remains for only a few nanoseconds before the counters reset and the displays change to 01:00:00. The BCD output from the hours counter Q16 is connected to the decoder/driver Q18 which drives the hours LED display, D5. During the 10 to 13 hours segments of time, the flip-flop Q14 also gates the A input of the

tens of hours decoder/driver, Q19, to change from 0 to a 1 on the tens of hours display, D6.

The digital clock is synchronized with WWV by advancing the counters with the 1 Hz signal from the output of Q3. Switch SW1 is switched from the "OFF" to the "SET" position to advance the counter selected by the time advance switch SW2. After all of the counters have been preset to the next upcoming WWV timing tone, the clock is left in a stand-by state by leaving switch SW1 in the "OFF" position. The clock is then restarted and synchronized with WWV by placing switch SW1 in the "ON" position when the timing tone is transmitted by WWV.

The IC circuitry and power supply were built separately and mounted on a stained hardwood base place (20.3 x 25.4 cm). The clock is covered by a smoked plastic box (20.3 x 20.3 x 15.2 cm). A 15.2 x 17.8 cm ventilation hole was cut out in the back of the box, then covered by a metal screen. All of the 19 integrated circuits and six LED displays can be laid out and wired with No. 28 insulated wire on a 15.2 x 15.2 cm "P" pattern, Micro-Vectorbord (see Fig. 1). The "P" pattern Micro-Vectorbord has pre-punched holes spaced on .254 cm centers which is identical to that of dual-in-line circuits and LED displays. The use of IC sockets to hold the integrated circuits and LED displays, although not required, greatly facilitates the pin-to-pin wiring. Strips of .32 cm wide uninsulated braid should be used for the VCC and ground lines which run parallel to each row of IC's as shown in Fig. 1. Each of the six VCC lines should be decoupled with a 100 μF capacitor to insure low impedance signal return paths. Number 28 insulated wire should be used from the circuit board to switches SW1 and SW2, and should be kept as short as possible to minimize wire to wire capacitance.

The power supply was constructed on a 17.8 x 8.9 x 2.54 cm aluminum chassis. A heat sink must be used with the series regulator transistor in the power supply. Connection between the power supply and the IC circuitry was made with a standard three conductor phone plug and jack.

...WA6QVQ

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THE REGENCY HR-2A WALKIE-TALKIE

Listening in on the local 2 meter repeaters, it becomes obvious that one or two watts output from a transmitter can do a fine job in walkie-talkie type operation. This is what prompted the work to reduce the power output of the Regency HR-2A transceiver. At the rated 15 watts output, the battery drain on transmit is 3 amperes. An early attempt at using this rig on D-cells was most disappointing. The battery drain was excessive and they ran down in no time at all.

In analyzing the circuit of the transmitter, the method by which to reduce power soon became obvious. The vswr protection circuit can be used to reduce the drive to the power amplifier stage and so the output. In normal operation, if the swr is high enough, it can actually cut off the output completely. This is to prevent damage to the expensive power output transistor.

As the vswr increases, a positive voltage from diode CR 301 is applied to the base of transistor Q304, causing the transistor to conduct. This reduces the bias on Q305 which has the effect of adding resistance into the emitter circuit of the tripler stage Q306. Varying the emitter resistance is the method used to control the output of the tripler and also the drive to the following stages.

The power output of the HR-2A transmitter can be reduced for portable operation by adding a small positive voltage to the base of transistor Q304. This was accomplished experimentally by using a battery pack delivering 13.5 volts. A 15000 ohm resistor in series with the positive lead and connected to the base of transistor Q304 reduced the power output to three watts as measured on a Bird Termaline dummy load-wattemeter. At this output the battery drain during transmit was 1 ampere. Using an antenna having a finite swr, the protection circuit comes into play and adds an additional positive voltage to Q304. This has the effect of further reducing the power output as well as the battery drain. Another interesting point to note is that as the batteries start to run down the voltage on the base of the control transistor is reduced. This results in an increase of the transmitter output to compensate for the failing batteries.

Installation

The actual installation of the power reduction circuitry can be completed in less than a half hour and is extremely simple. On the printed circuit side of the transmitter board Regency has added a 1000 ohm ¼ watt resistor to permit the HR-2A to operate at full output with a slightly elevated swr. One end of this resistor goes to the base of transistor Q304 while the other end goes to ground. At the base end, solder a length of wire. Attach another lead to the transmitter side of the on-off switch. The proper terminal of the switch can be determined with an ohmmeter. With the switch in the off position you should get a reading of about 40 ohms to ground. The other terminal should show an open if no power supply is connected. Toward the rear-center of the transceiver there are a number of

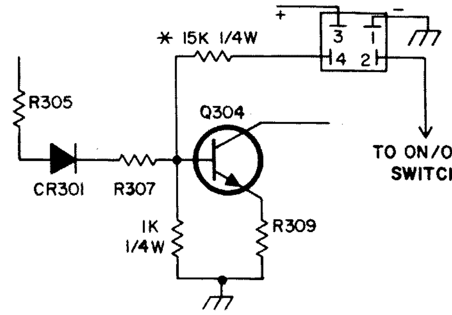

*Fig. 1. *Added resistor.*

small holes that are not being used. The 15000 ohm ¼ watt resistor can be inserted into two of these holes and soldered to the foil. The lead from the 1000 ohm resistor should be run along the edge of the transceiver and connected to one end of the 15K resistor. The other end of this resistor should be connected to the power socket on the terminal beneath the positive supply lead. The wire from the switch goes to the other terminal of the power socket. This completed the wiring.

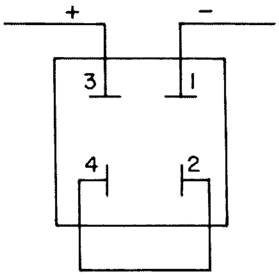

Fig. 2. Power plug for walkie-talkie battery plug only.

A battery pack was built up using 9 D-cell size Alkaline cells in series to supply the necessary 13.5 volts. In addition to the positive and negative leads to the plug a jumper is added across the other two terminals. This automatically cuts in the power reduction circuit when using the battery pack. The jumper is not used on the plugs for the ac and mobile cords permitting the full 15 watts output.

Operation of the Regency HR-2A has been most reliable at the reduced output. A partial circuit, showing the modification, is shown in Fig. 1, while Fig. 2 shows the power plug on the transceiver.

. . .W2KPE

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DIFFERENT MOBILE AND FIXED ANTENNAS

designed to improve 2m FM

Tired of spotty, picket fence mobile operation on 2m FM into your favorite repeater? Read on your XYL will hate you, but you'll love the new range and Q5 reports.

Whitmore Lake is about 65 road miles from the Detroit River, and about 40 miles from the Detroit repeaters. The nearest repeater is ARROW on 37–97 in Ann Arbor, about 10 miles away. To work into the DART or Great Lakes repeaters took a high hill, power, or a lot of luck, with a multitude of dead spots throughout the area. The problem was how to work into Detroit with a Rising Sun Special 15W Super Sniffer? An amplifier would certainly do the job, but the cost was too much for the household budget, without giving up Saturday night popcorn. So the idea changed from increasing power to increasing effective radiated power (antennas to you appliance ops). To increase antenna gain from a ¼ wave to a 5/8 wave antenna (about 3½ dB) is easy. Go down and buy a new antenna for about $30, a mount, and drill a new hole, or go a different way, save the car, and get more gain. A ½ wave antenna seemed the answer, as it is about as long as the average 5/8 whip and offers a smidgeon more gain. To eliminate flutter, a solid or very stiff radiator was needed. Not wanting to be outdone, by mounting the half wave above a ½ wave mirror image would give 3–4 dB more gain.

My XYL notwithstanding, it was decided to spend $12.50 on a CushCraft Ringo, a fixed station antenna, and mount it on the car – no mean task indeed. Since the antenna is 38 in. from top insulator to top of radiator, and a ½ wave mount would also be 38 in. and all solid as a rock, it looked like a good tree trimmer project like the old 160 meter mobile monsters. But a little ham ingenuity proved to be the fitting touch. Mount a standard roof rack luggage carrier (single bar) near the front of the old VW square back. Mount two plumbing floor flanges, one on top and one on the bottom

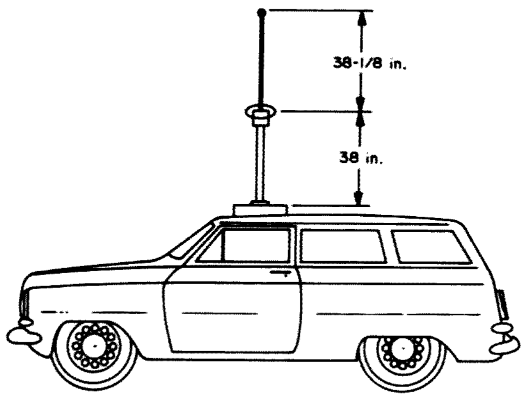

Fig. 1. Mounting the Ringo antenna ½ wavelength above the automobile's roof does wonders for your radiation pattern.

with 3/16 in. bolts, two of which run through the carrier holes. Screw a 31 in. long 1 in. OD water pipe in the top flange, weld a 6 in. stainless steel spring on top of the pipe and a 4 in. piece on top of the spring and mount the Ringo on top of the 4 in. piece. *Shazam,* a new super mobile antenna which doesn't get permanent wave treatment on bridges or trees. Leaving the spring out can cause a lot of trouble, as the first model proved.

RG-8 was used for feed line, dressing it down the support pipe and in through a side window in the VW. The rig used for all tests was a Drake ML-2.

Now, what about results? Fantastic! While the useful limit of range into Detroit was west to a few miles past Ann Arbor, range was now extended to Jackson, Michigan, with spotty results from Parma. An increase of 30–40 miles. Nothing short of spectacular.

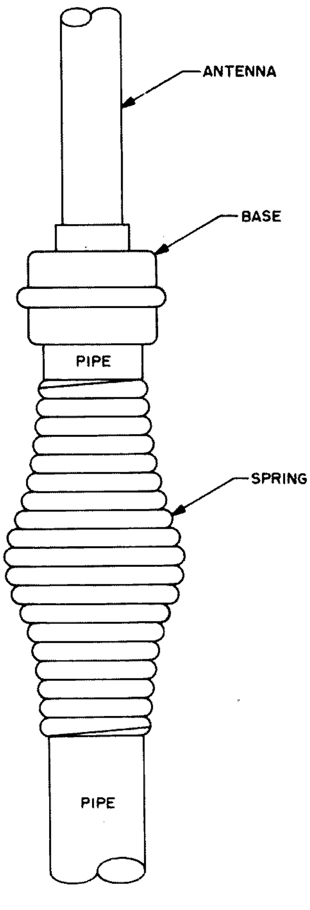

Fig. 2. A spring is used as the Ringo/pipe junction . . . this makes it easy on those low hanging branches.

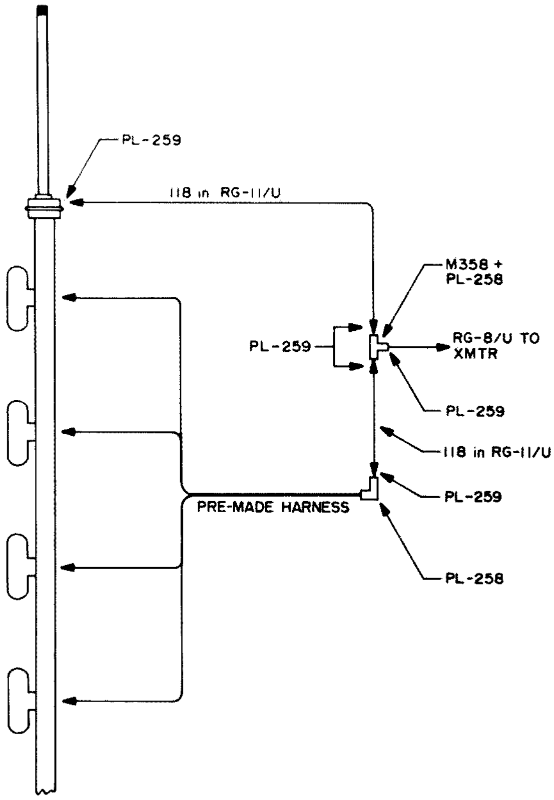

Fig. 3. The Ringo can be added to a dipole array to improve the radiation pattern.

Now what do you do if you bought the Ringo and won't break down and put it on your car (or the XYL said nothing doing to the family chariot). Stack it on top of a 4 dipole array for additional gain and range. If the dipole is set up for unidirectional coverage, the CushCraft Ringo, when mounted 38 in. above the topmost element of the other antenna will fill in the back and side areas to round out the pattern with some additional forward gain. If the vertical dipoles are arranged for omnidirectional gain, the figure and range are increased in all directions. Again, the bottom insulator of the Ringo should be 38 in. above the top of the uppermost dipole element. To match into a 50Ω coax, make a harness of two lengths, each 118 in. long of RG11 solid coax. Connect one end to the Ringo, the other to the end of the harness supplies by the dipole manufacturer (i.e., FM4D) and connect the other ends to a T connector, to which you connect the coax from your transceiver. If this still doesn't give you enough range, buy an amplifier.

. . .WB8HEE

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TWO METER FM TRANSMITTER

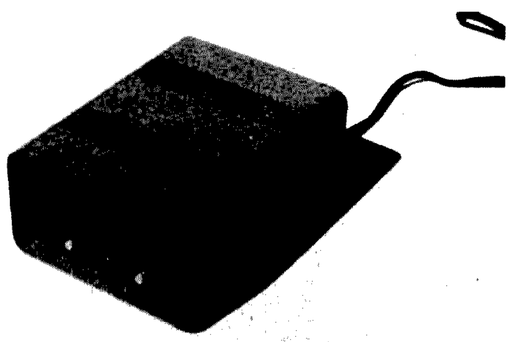
An inexpensive rig offering compact construction without sacrificing circuit quality.

This article describes a simple narrow band two meter FM transmitter that uses inexpensive transistors and provides a little more than one watt output. It features double-tuned circuits for selectivity, a mosfet buffer for frequency stability, and voice-shaped audio frequency response.

For the amateur who has had some experience in solid state VHF circuitry, this transmitter can provide a convenient and inexpensive way to join the activity on the local repeater. Although this article describes a base station unit, this circuit could also be used as part of a handy-talkie or mobile installation.

The Circuit

The transmitter is built in three semi-modules; the voltage controlled crystal oscillator (VCXO), the amplifier-doubler (Amp-Doubler), and the power supply. Figure 1 shows the VCXO. Two 40398's amplify a ceramic or crystal microphone input to drive a pair of MV-835 varicap diodes. Bypass and coupling capacitors were selected to give a one dB 300 to 3000 Hz bandpass. A small amount of negative feedback was used on the second 40398 (100 K resistor) to reduce excessive gain, while slightly reducing distortion in that stage. It may also help to improve bias stability, thus improving the frequency stability of the oscillator since the



varicaps are biased directly by the collector of the 40398. Using this direct coupling eliminates the need for a coupling capacitor and separate bias for the varicap. The varicap would be biased at the same voltage as the collector quiescent voltage anyway. The only drawback is the fact that the frequency stability is dependent on the bias stability of the 40398. Using two varicaps in parallel provides more dynamic capacitance change, even though it doubles the total capacitance. Direct FM is used on the 18 MHz fundamental cut crystal. The crystal was cut for a 20 pF load capacitance. The 2N918 oscillator uses an old and familiar circuit to drive a 3N128 mosfet buffer. The common source buffer provides about 1.3V rms at the input of the Amp-Doubler. The use of a mosfet buffer reduces the problem of frequency "pulling" caused by tuning or load changes in the Amp-Doubler.

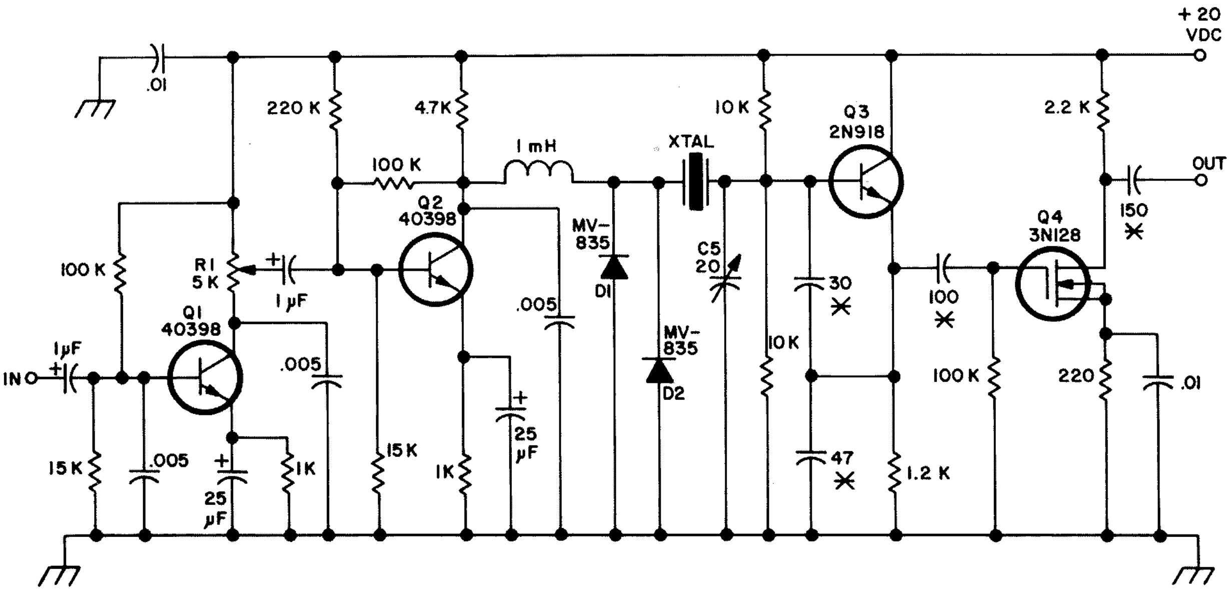


*Fig 1. VCXO Board. Capacitors marked with + are electrolytic. Capacitors marked with * are mica. Other capacitors are disc ceramic. C5 is a small ceramic trimmer.*

A 24V rms 20 volt-amp power transformer, a bridge rectifier, and a large filter capacitor provide 28 volts to drive the last three stages of the Amp-Doubler. A dropping resistor and zener diode with another large capacitor give clean regulated voltage for the VCXO and first doubler.

The Amp-Doubler is the most interesting and most difficult part of the transmitter. Many basic considerations go into VHF transmitter circuitry. As frequency decreases there is a six dB per octave increase in transistor gain. This can give a stage much higher gain at lower frequencies, and cause low frequency oscillation. This type of oscillation can usually be traced to poor power supply bypassing, component self-resonances, or rf choke resonances with other circuit capacitances. Each stage must be bypassed so as to be affective at lower frequencies as well as at VHF. This is the reason for dual bypass capacitors. Any rf chokes should be low Q. Wirewound resistors and ferrite beads have good success, but ordinary carbon resistors can be used with a Q of almost zero. Collector rf chokes can be eliminated by using a coil that is part of the tuned circuit to supply B+ current. Interstage coupling was accomplished by experimentally tapping coils to obtain an approximate match. Efficiency could probably be much better, but each stage could be easily driven to meet or exceed its power rating. Resistors are used across tuned circuits where necessary to reduce any tendency toward parasitic oscillation. Since the first two stages use double tuned circuits, the problem of unwanted harmonics from the oscillator getting through are greatly reduced. This makes two tuned circuits at each multiplied frequency.

Construction

A popular small size LMB cabinet (LMB No. CO-3) was used for this project. The first step was to secure parts for the power supply and assemble it on the chassis provided with the cabinet. The VCXO was assembled quite easily with the pc board layout provided for it. All parts on the VCXO were mounted by soldering directly to the board, including the HC 18/U crystal. The board was a double clad epoxy type with enough of the foil on top of the board etched away for the components to pass through. The top foil is then grounded to the outer bottom foil. Since it was difficult to find a small 5K audio taper potentiometer in a small size at low cost, a standard transistor radio control was used. The lugs for the switch on the pot were simply cut off and not used. The frequency trimmer capacitor with about 20 pF could have been used. Tubular components such as resistors

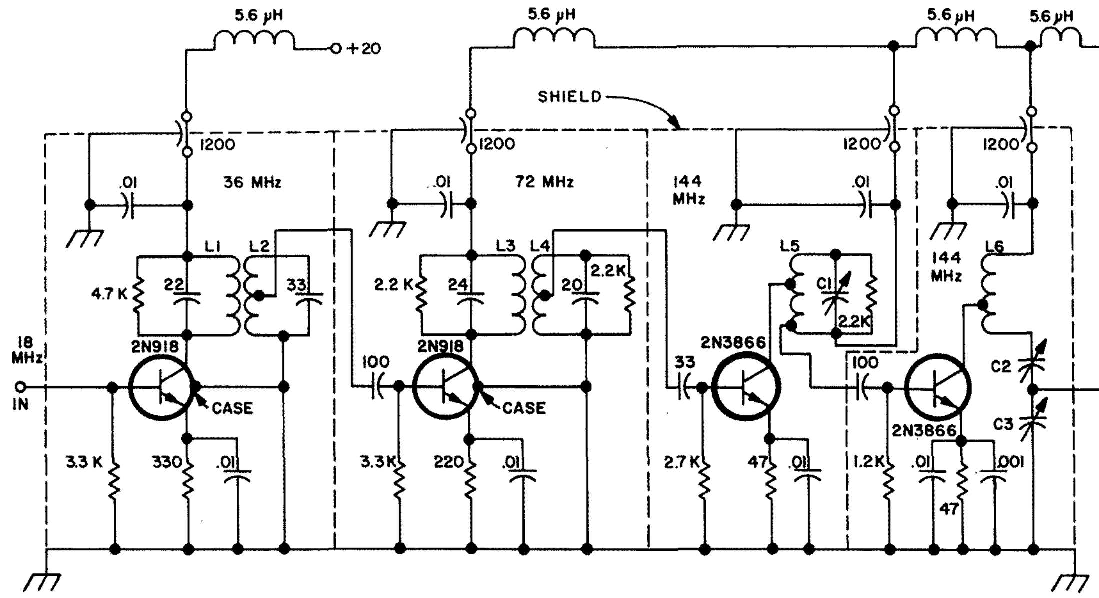


Fig. 2. Amplifier-Doubler strip. Unmarked parts: L1 – 10 turns #26; L2 – 10 turns #26 center tapped; L3 – 8 turns #24; L4 – 8 turns #24 center tapped; L5 – 5 turns #24, 3/8" long, tapped at 1.5 turns and 3 1/4 turns from the "cold end"; C1 – 2.5 to 11 pF; C2 – 5.5 to 18 pF; C3 – 3 to 15 pF. (L1 through L5 wound on 10/32 Glastork forms. L1, L2 – iron slug, L3, L4 – brass slug.)

and electrolytic capacitors were mounted perpendicular to the board to conserve board space. After completing the assembly, the shorting wire was removed from the leads of the 3N128. The leads were shorted together to prevent damage to the insulated gate junction. No trouble was encountered with the VCXO, and both units that were built worked the first time. It was possible to hear the output of the VXCO in a nearby FM receiver on the two meter frequency. As a matter of fact, with about a foot of wire on the VXCO, it could be used as a transmitter with a range of about fifty feet.

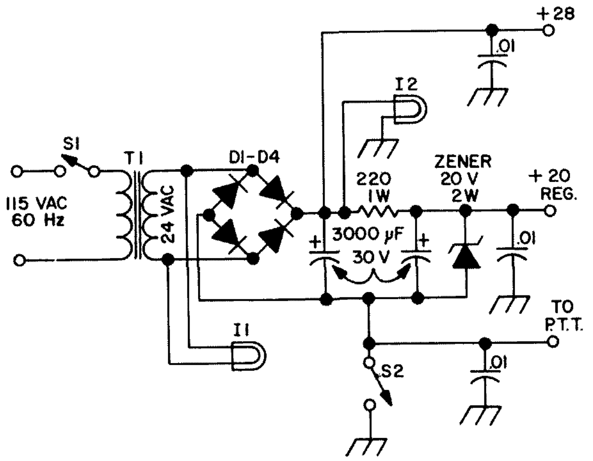


Fig. 3. Power supply. T1 has a 24V, 20 volt-amp secondary. D1–D4 are 400 PIV one amp. S1 and S2 are SPST toggle switches and the two pilot lamps I1 and I2 are 28V surplus.

As previously mentioned, the Amp-Doubler is the most important part of the transmitter. Generally, circuit layout and construction are most important in VHF transistor amplifier design. The chassis should be highly conductive and copper is generally used because of its availability in pc board stock. Since the copper foil is thin, it is light and easy to heat for soldering, and the epoxy board provides excellent strength. Epoxy board provides excellent strength under soldering and unsoldering of experimentation. Short and direct wiring is standard procedure for rf circuitry since any conductor has a resistive and inductive component that may be significant compared to other circuit impedances. All grounds in a stage should be as close together as possible because the chassis may have significant inductance between ground points. Good emitter bypassing is important for good gain in common emitter stages. Unwanted interstage coupling causing instability can be noticed by strange tuning characteristics as well as outright oscillation. Care should be taken to see that each tuned circuit tunes smoothly to a relatively broad peak, and drops off symmetrically on both sides of the peak. Of course, the circuit should be checked to see that it tunes both above and below the desired frequency so that the peak

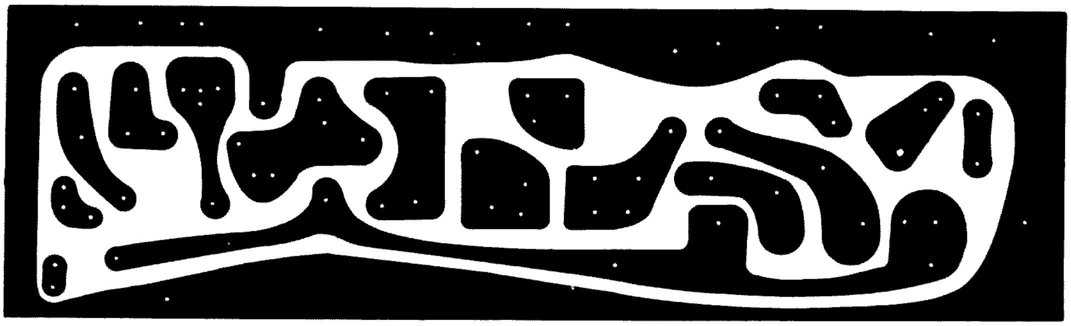
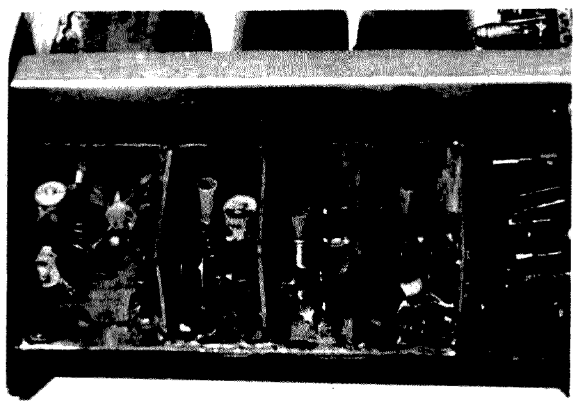


Fig. 4. Full size printed circuit VCXO board layout.

is at actual resonance. Sharp peaks indicate instability caused by regeneration. This is similar to the effect of a Q multiplier, set just before actual oscillation. If sharp peaks or strange tuning characteristics appear, they can usually be eliminated by putting resistors across tuned circuits. Resistors between 470 and 4700 ohms usually will give desired results. Using resistors in this way can be thought of as a cheap and dirty cure for poor components and layout, but it works. In any case, complete stability should be attained before putting the transmitter on the air, and efficiency is a secondary consideration. The common practice of tuning and experimenting with a minimum of shielding, and closing the shielding after the circuit is stable provides a safety factor on stability. Heat dissipation is a major limiting factor in solid state circuitry. Care must be taken to assure that transistors are not destroyed during prolonged periods of tuning since mismatch conditions produce highest heat dissipation. In normal operating, transistors in the Amp-Doubler strip are running near or exceeding their continuous duty dissipation. The transistors will become quite hot if the transmitter is keyed continuously, but normal FM transmissions are seldom more than a few seconds long on a busy repeater. If adequate heat sinks were provided, the transistors would be within their ratings, however.

Specifically, the Amp-Doubler housing was built of double clad printed circuit board. Partitions between stages stiffen the structure, provide shielding, and holes in the shields allow coupling. Components were assembled by soldering their leads together as closely as possible. The coils were wound on Glastork 10/32 coil forms. These forms were obtained from Coilform Co., Kaneville Rd. at Randall Rd., Geneva, Ill. 60134. LI and L2 were wound on the same form in the first section of the Amp-Doubler. After final tweaking, the windings were about ¼" apart on the form. The cores (slugs) in the first two coils were obtained from Micrometals, 228 No. Sunset, City of Industry, CA 91747, part number 36-1185. When the first doubler is completed, it can be checked. Drive and power was measured by measuring the voltage drop across the emitter resistor. 1.5V was obtained across the 330Ω resistor, giving 45 mA. This makes about 80 mW, but transistor and other component characteristics will vary, making different transmitter versions different. After it was established that the first stage was being driven, the output was tuned with the aid of a grid dip meter used as a wavemeter. No instability was encountered until the following stage was assembled. At this time, resistors were added to stop the instability. Drive to the following stage was measured by measuring its emitter voltage and tuning the previous



Doubler and amplifier section of transmitter. Note the heat sinks and shielding.

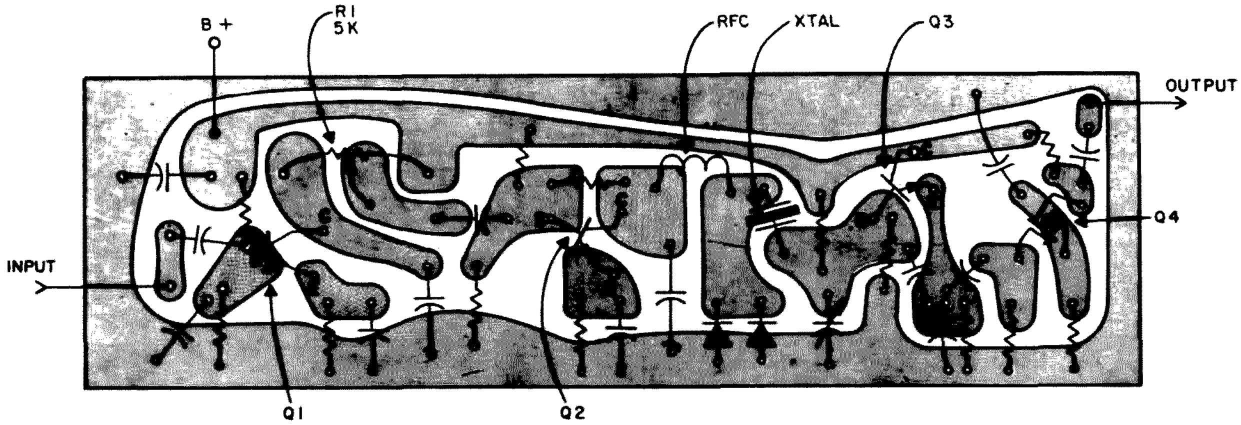


Fig. 5. Approximate locations of parts on VCXO board.

stage for a maximum. The slugs in L3 and L4 were made by cutting off brass bolts and sawing a notch in them to allow tuning. The other stages are capacitor tuned. The capacitors were the JFD DV11 type, as listed in the schematic. Coil forms are mounted vertically in the housing through holes in the chassis, and secured with epoxy. L5 and L6 were mounted perpendicularly to each other to reduce spurious coupling. After drive and output was obtained in all stages, final adjustments were made to obtain desired power levels. Coupling taps on coils, and coupling capacitors were adjusted for drive. Emitter resistors were adjusted, making them smaller to increase transistor voltage and power, or larger to provide greater safety. This final tweaking is mostly a matter of personal feel, looking for smooth tuning, good efficiency, and good power. After everything was set, the coils were doped, cold solder joints cleaned up, and components epoxied down securely. A hair dryer was found to be very helpful to make the epoxy flow smoothly and cure fast. Some care was taken to prevent epoxy from connecting rf points to ground because it does have some conductance. Finally, the last portions of the shield were soldered in place as well as possible, considering the lack of space while reaching down inside the shields. A last clean-up can be made with a solvent such as toluene or lacquer thinner to remover solder resin and other small foreign particles.

Top view of VCXO board.

Conclusion

The results of this project were completely successful as they were planned. The one watt power is completely adequate for use in a repeater system, and increasing power would be very expensive compared to the cost of a one watt stage. To get a good ten dB power gain would cost about another ten dollars in transistors alone. A big mistake on this project was making the transmitter a single channel device. This depends on local activity, of course, but three channels should be about right. With a tripler and amplifier it should be possible to get a watt on 450 MHz, but test equipment (and experience) are lacking. This would make an excellent base station, and tripling would give wideband deviation which is still used on 450. The audio on this transmitter was left linear, but all sorts of audio clipping and compression can be used to increase intelligibility.

Circuit boards will be available from MFJ Enterprises, P.O. Box 494, State College MS 29762.

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"MINI" REPEATER CONTROL SYSTEM PART II

Part 1 described a "Mini" Repeater Control system composed of approximately 30 integrated circuits. (This count includes basic system logic, identifier, identifier decoding, and lamp drivers for the diagnostic test set.) The control system included timers, an identifier, and the related logic to fully implement a repeater equipped with an autopatch. The system used a method of construction designed to allow the system components to be easily accessed for servicing. A modular approach was employed and featured a Diagnostic Test Set to facilitate stand-alone testing as well as system performance monitoring.

Diagnostic Test Set

Photo 2 shows how the diagnostic test set (DTS) is interconnected with the system logic unit (SLU) for bench testing. The DTS consists of a series of switches and lamps and an integral audio oscillator. The switches are used to simulate inputs to the control logic comparable to those normally generated by the "support" circuits, i.e., carrier detector, tone detector, ring signal detector, etc. The lamps are used to display the formal outputs as well as intermediate test points. The oscillator is provided to facilitate evaluation of the identifier and pseudo ring signal indicator.

When the test set is used to monitor the "live" system, the simulation switches are all placed in the OFF position (except for the RING signal switch). The switches should be operated only when a bench diagnostic is being performed. In the case of a few switches such as RPTR ENABLE, PATCH ENABLE, and BURST, the switches can be operated to control the mode of the system's operation. More typically, though, external contacts, controlled via a landline or radio link, are used to provide the contact closures analogous to the simulation switches.

Photo 3 shows the front panel of the diagnostic test set. Notice the pushbutton switch provided for simultaneous lamp and oscillator test. The TEST switch was included so that the unit's basic test aids could

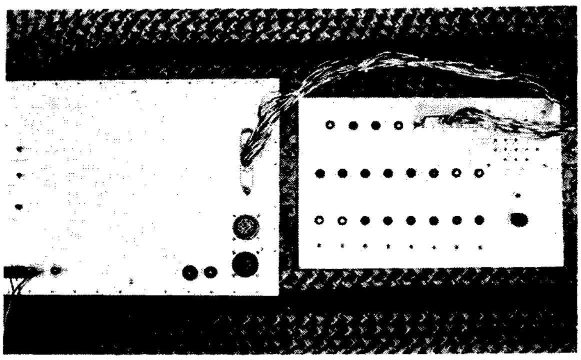

Photo 2. DTS interconnected to the system logic unit for bench testing.

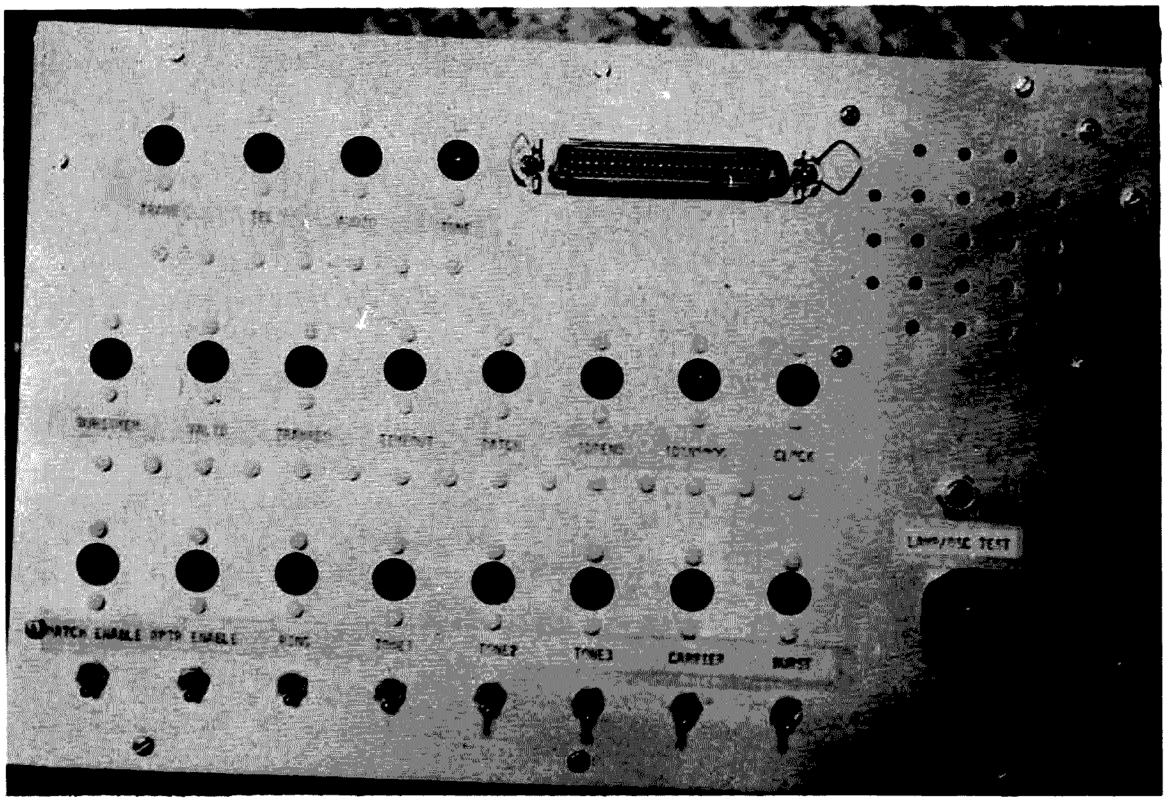

Photo 3. Front panel of diagnostic test set.

be verified prior to beginning a diagnostic sequence; pushing the TEST switch should cause all of the lamps to light and should simultaneously cause the oscillator to be heard in the monitor speaker. The lamp display consists of 20 individual lamps arranged (top-to-bottom) as formal outputs, informal outputs (test points from within the control logic), and inputs. There are 8 switches for simulating various input combinations.

Test Procedure

With 8 different input switches, each capable of being turned either ON or OFF, it is possible to configure 256 different switch settings! Fortunately, we are not interested in all of the combinations. In addition, since the logic being tested incorporates memory elements and timers, the proper output is not predictable in terms of the inputs alone; we need to establish an orderly sequence of instructions – a program – which can be followed to systematically evaluate the system control logic. It is necessary to establish a known starting point and then perform the step-by-step analytic procedure. A known starting point is established by the logic initialization switch (INIT) included as an integral part of the System Logic Unit.

The following paragraphs present the individual "programs" required to evaluate the system control logic. In all of the programs, "VERIFY" steps indicate the *expected* response; failure to observe this response indicates an abnormality. In many cases there will be responses that need not be verified and should therefore be ignored, e.g., an I.D. may be produced as a natural part of the normal operation and yet may not be of interest to the particular test in progress.

Initialization Program

The initialization program verifies that the basic test circuits are functioning properly before they are used to evaluate the system logic. The program verifies proper operation of the following:

a. lamp display
b. audio oscillator
c. identifier
d. transmitter keying

1. Interconnect the Diagnostic Test Set (DTS) and System Logic Unit (DTU) as shown in Photo 2.

2. Attach power leads to the banana plugs on the SLU. *A 12V, 2A, source is required; a battery or regulated supply may be used.*
3. Place all simulation switches in the OFF position. *This assures a known set of initial inputs to the logic.*
4. Turn POWER switch ON (located on SLU). *This switch controls the distribution of 12V to the SLU and DTS.*
5. Verify pilot light on SLU. *The pilot light is connected to the output of the SLU's 5V regulator. When the light is on, it indicates that 12V is available to both units and that 5V is available to the SLU.*
6. Perform Lamp/Oscillator test. *Press the lamp/oscillator TEST switch on the DTS; all lamps should turn on. Careful examination of the lamps in the off state should reveal that the lamps are slightly on all of the time.*
7. Momentarily press the Logic Initialization (INIT) switch; wait for BURSTMEM to extinguish. *The initialization switch (INIT) forces the logic into the repeater mode, clears any pending identification, and terminates an ID-in-progress.*
8. Press KEY switch on SLU; verify TRANS light ON on DTS. *The KEY switch causes the transmitter to be keyed; the TRANS light is turned ON whenever the transmitter is keyed.*
9. Momentarily press I.D. button on LSU; verify I.D. sequence in DTS speaker. *This checks out the identifier.*

Input Signal Program

For each of the 8 simulation switches, perform the following steps:

1. Place switch in ON position.
2. Verify that the associated lamp is ON.
3. Place switch in the OFF position.

NOTE: At the completion of this test, all switches should be in the OFF position. Because the RING switch was operated, an I.D. will be generated. Because the BURST switch was operated, the BURSTMEM lamp will be on for 5 seconds.

Ring Signal Program

1. Set RING switch ON. *This simulates the presence of a ring signal on the telephone line.*
2. Verify tone in speaker. *This is indicative of the audio that would be directed to the transmitter.*
3. Verify TRANS light ON. *The transmitter is keyed to broadcast the ring signal.*
4. Set RING switch OFF. *Remove the simulated ring signal.*
5. Verify I.D. 8 seconds after performing step 4. *Use of the transmitter requires an eventual identification; the anticipator causes the I.D. to be generated.*
6. Set RING switch ON. *Simulate telephone ring signal.*
7. Press ID button on SLU. *Initiate an I.D.*
8. Verify blockage of pseudo ring signal during I.D. *The ring signal should be present before and after the I.D.*
9. Set RING switch OFF. *I.D. will follow.*

Repeater Program

1. Set RPTR ENABLE switch ON. *Allow use of the transmitter for repeater or autopatch operation.*
2. Set CARRIER switch ON. *Simulate the presence of a signal on the input frequency.*
3. Set Burst switch ON. *Simulate receipt of a burst tone.*
4. Verify TRANS light ON. *The TRANS light should come on only if a signal is accompanied by a burst tone.*
5. Set BURST switch OFF. *A burst tone is only required at the beginning of a transmission.*
6. Verify TRANS light ON. *Although the burst tone is removed, the transmitter should remain keyed; this is the basic logic of burst access.*
7. Set CARRIER switch OFF. *Remove the simulated input signal.*
8. Verify BURSTMEM light OFF 5 seconds after performing step 7. *The BURSTMEM light represents the amount of time during which a new carrier will be accepted without a burst tone.*
9. Verify I.D. 8 seconds after performing step 7. *Because the transmitter was used, an I.D. is pending and will be initiated by the anticipator.*
10. Set RPTR ENABLE switch off.

Autopatch Program

1. Set RPTR ENABLE switch. *All on repeater operation.*
2. Set CARRIER switch ON. *Simulate a signal on the input.*
3. Set BURST switch ON. *Allow signal to be acknowledged.*
4. Verify TRANS light ON. *Transmitter is granted.*
5. Set BURST switch OFF. *Burst tone is required only for initial access.*
6. Set PATCH ENABLE switch ON. *Allow the "*" to configure the system as an autopatch when it is received.*
7. Set TONE1 switch ON. *First tone for "*" character.*
8. Set TONE2 switch ON. *Second tone for "*" character.*
9. Set TONE1 and TONE2 switches OFF. *Remove the "*" character.*
10. Verify PATCH light ON. *The patch mode is entered when the "*" is received.*
11. Verify TRANS light ON. *The transmitter should be enabled for the patch (providing ENABLE RPTR is ON).*
12. Verify AUDIO light ON. *The audio input to the transmitter is switched when a carrier is present and the system is in the patch mode (see step 1).*
13. Verify TEL light ON. *The telephone line should be connected when the "*" character terminates.*
14. Set CARRIER switch OFF.*Remove the signal from the input.*
15. Verify AUDIO light OFF. *The input to the transmitter is not switched when a carrier is not present.*
16. Set CARRIER switch ON. *Simulate a signal on input.*
17. Set TONE1 and TONE3 switches ON. *Simulate the "#" character.*
18. Verify PATCH light OFF. *The system should revert to the repeater mode when the "#" character is received.*
19. Set CARRIER switch OFF. *Remove the input signal.*
20. Verify I.D. 8 seconds after performing step 18. *An I.D. will be pending due to the transmitter usage; the anticipator will generate the I.D.*
21. Set PATCH ENABLE; RPTR ENABLE, TONE1, and TONE3 Switches OFF.

2-Minute Timer Program

1. Set RPTR ENABLE switch ON. *Allow repeater operation.*
2. Set CARRIER switch ON. *Simulate a signal on the input frequency.*
3. Set BURST switch ON. *Simulate signal accompanied by burst tone.*
4. Set BURST switch OFF. *Burst tone is only required at the beginning of a transmission.*
5. Verify TRANS light ON. *Input signal is being repeated.*
6. Verify TRANS light OFF two minutes after performing step 2. *The transmitter should be disabled when a carrier persists on the input frequency.*
7. Verify TIMEOUT light ON. *The timeout flip-flop is set when a two minute timeout has occurred.*
8. Verify I.D. 8 seconds after the TRANS light is turned OFF by shutdown (step 4). *Timeout removes the transmitter request and the anticipator produces an I.D.*
9. Set CARRIER switch OFF. *Remove simulated input signal*
10. Verify TIMEOUT light OFF. *Timeout flip-flop is reset when the carrier is removed from the input frequency.*
11. Set RPTR ENABLE switch OFF.

NOTE: A seemingly inappropropriate I.D. may follow Step 9 due to contact bounce in the simulation switch.

1-Minute Timer Program

1. Set RPTR ENABLE and PATCH ENABLE switches ON. *Allow repeater and autopatch operation.*
2. Set CARRIER switch ON. *Simulate a signal on the input.*
3. Set BURST switch ON. *Accompany signal with burst tone.*
4. Set BURST switch OFF. *Burst signal is momentary.*
5. Set TONE1 and TONE2 switches ON. *Simulate "*" character.*
6. Set TONE1 and TONE2 switches OFF. *Simulate removal of "*" character.*
7. Set CARRIER switch OFF. *Remove the input signal; this implies that the telephone party is talking.*

8. Verify TRANS light OFF, TELLIGHT OFF and PATCH light OFF one minute after performing step 7. *User must transmit once each minute or system reverts to the repeater mode.*
9. Verify I.D. 8 seconds after TRANS light is turned OFF. *Pending I.D. is generated by the anticipator.*
10. Set PATCH ENABLE and RPTR ENABLE switches OFF.

3-Minute Timer Program

1. Set RPTR ENABLE switch ON. *Allow repeater operation.*
2. Set BURST switch ON. *Simulate open access.*
3. Set CARRIER switch ON for one minute. *Simulate signal in input frequency.*
4. Momentarily reset CARRIER. *Turn CARRIER switch OFF and then back ON.*
5. Set CARRIER switch ON for one minute. *Simulate signal in input frequency.*
6. Momentarily reset CARRIER. *Turn CARRIER switch OFF and then back ON.*
7. Set CARRIER switch ON. *Simulate signal on input frequency.*
8. Verify I.D. three minutes from start of second step. *The system has been in use for three minutes without the anticipator producing an I.D. and so an I.D. is required and generated by the 3-minute timer.*
9. Verify two minute shutdown; timeout light ON. *Step 6 generates a continuous carrier on the input frequency.*
10. Verify I.D. 8 seconds after the shutdown. *The shutdown occurs 1 minute after the 3-minute I.D.; since the transmitter has been in use after the I.D. and additional I.D. is pending and will be produced by the anticipator.*
11. Set BURST, RPTR ENABLE and CARRIER switch OFF. *Expect I.D. from contact bounce.*

2-Minute Timer Program (Autopatch Mode)

This program evaluates the 2-minute timer when the system is in the autopatch mode.

1. Set RPTR ENABLE and PATCH ENABLE switches ON. *Allow repeater and patch operation.*
2. Set CARRIER switch ON. *Simulate an input signal.*
3. Set BURST switch ON. *Accompanied with burst signal.*
4. Set BURST switch OFF. *Burst tone is momentary.*
5. Set TONE1 and TONE2 switches ON. *Simulate "*" character.*
6. Set TONE1 and TONE2 switches OFF. *Simulate removal of "*" character.*
7. Momentarily reset carrier. *Turn CARRIER switch OFF and the back ON.*
8. Verify TRANS light OFF and PATCH light OFF two minutes after step 7. *A continuous carrier on the input frequency during the patch mode causes the system to shut down the transmitter and revert to the repeater mode.*
9. Verify I.D. 8 seconds after the system reverts to the repeater mode. *The pending I.D. is generated by the anticipator.*
10. Set CARRIER, PATCH ENABLE, and RPTR ENABLE switches OFF. *Expect I.D. due to contact bounce.*

I.D. Clock Signal Program

1. Momentarily depress I.D. pushbutton on SLU. *Initiate an I.D.*
2. Verify consistent flash rate of CLOCK lamp. *The clock generator output is not directly sampled since the clock pulse is of such duration that a lamp would not respond. The clock is indirectly examined by looking at the output of gate I3 which reflects clock and flip-flop integrity.*

Tone Generator Program

1. Depress I.D. button on SLU. *Initiate an I.D.*
2. Verify TONE light ON in synchronism with audio heard in monitor speaker. *The TONE light simulates the system's tone oscillator used to generate the pseudo ring signal and I.D.*

Validated Carrier Program

1. Set CARRIER switch ON. *Simulate a signal*

2. Set BURST switch ON. *Accompanied by burst tone.*
3. Verify VALID light ON. *Carrier was accompanied by burst tone.*
4. Set BURST switch OFF. *Remove burst tone stimualtion.*
5. Verify VALID light ON. *A valid carrier is a carrier that is initially accompanied by a burst tone.*
6. Set CARRIER switch OFF. *Remove the input signal.*
7. Verify VALID light OFF. *A carrier is not present.*

Transmitter Requests Program

1. Set RING switch ON. *Simulate a telephone ring signal.*
2. Verify TRANREQ light ON. *The transmitter is requested when the telephone rings.*
3. Set RING switch OFF. *Remove pseudo ring signal.*
4. Set CARRIER switch ON. *Simulate signal on input frequency.*
5. Set BURST switch ON. *Simulate burst tone.*
6. Set ENABLE RPTR switch ON. *Allow repeater operation.*
7. Verify TRANSREQ light ON. *Transmitter requested by repeater.*
8. Set PATCH ENABLE switch ON. *Allow autopatch operation.*
9. Set TONE1 and TONE2 switches ON. *Simulate the "*" character.*
10. Set TONE1 and TONE2 switches OFF. *Remove the "*" character.*
11. Verify PATCH light ON. *System is in the autopatch mode.*
12. Verify TRANSREQ. *Transmitter is requested in patch mode.*
13. Set CARRIER switch OFF. *Simulate called party being broadcast.*
14. Verify TRANSREQ light ON. *Transmitter is keyed when in patch mode and carrier is not present.*
15. Set RPTR ENABLE, PATCH ENABLE and BURST switches OFF.
16. Momentarily depress INIT switch.

I.D. Pending Program

1. Set RPTR ENABLE switch ON. *Allow repeater operation.*

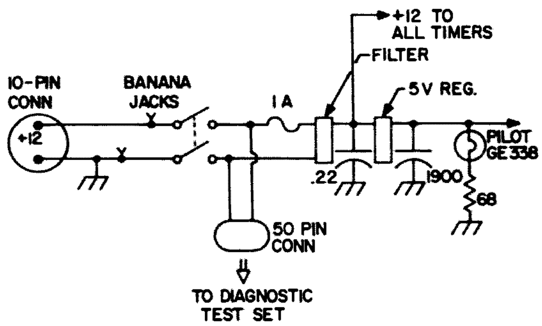

Fig. 12. Overall power distribution.

2. Set CARRIER and BURST switches ON. *Simulate use of the system as a repeater.*
3. Verify IDPEND light ON. *Because the transmitter has been used, and I.D. is pending.*
4. Set CARRIER and BURST switches OFF. *Remove the input signal.*
5. Verify I.D. 8 seconds after performing step 4. *The pending I.D. is generated by the anticipator.*

I.D. In Progress Program

1. Momentarily depress I.D. button on SLU. *Initiated an I.D.*
2. Verify IDINPROG light ON. *The light is ON while the I.D. is being generated.*

Power Distribution

The power for the system logic unit and the diagnostic test set enters via a 10-pin connector on the SLU. The voltage supplied via the connector is internally connected to a pair of banana jacks. This is to provide a parallel input path that is utilized when power is applied from a battery or bench supply during off-line testing. Figure 12 shows a general drawing of the power distribution technique.

The raw 12 volts is cleaned up to remove spikes by a filter network such as the one shown in Fig. 13. The 12 volts is then directly applied to the UJT timers discussed

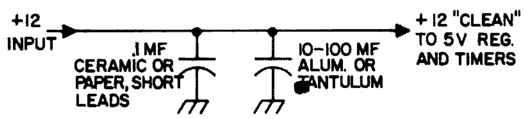

Fig. 13. 12V filter.

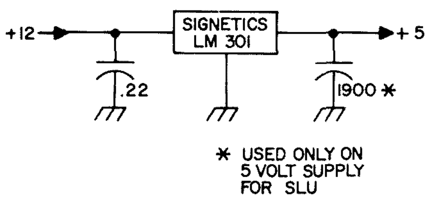

Fig. 14. Regulator circuit. Separate regulators are used for the logic unit and the test set.

in Part 1. A 5 volt regular is used to reduce the input voltage to the 5.0 volts required for the TTL logic circuits. A separate Signetics LM301 regulator is installed in the SLU and DTS; this approach minimizes the current requirements that would be required if a single regulator were used and does not provide an additional noise path into the SLU from the DTS (see Fig. 14).

The pilot light is attached to the output of the regulator in the SLU. The lamp is a GE 338 and is operated at reduced ratings to prolong the lamp life and minimize the current requirements (approximately one half the current required at 5 volts). When the light is ON it indicates that the regulator is producing output which in turn implies that the 12 volt input is present.

The power supply is fused in the 12 volt portion of the circuit for a current of 1 ampere; the 5 volt regulator incorporates current limiting and overvoltage protection as an integral part of the design.

The raw 12 volt input is controlled by a DPDT switch. When the switch is in the ON position, power is applied to the SLU and to the DTS (if the interconnecting cable is plugged into the 50-pin connector).

Figure 15 shows the power distribution scheme for the DTS. A fuse is again provided in the 12 volt line (1 ampere rating). There is no ON/OFF switch in the DTS since all 12 volt power is controlled by the switch in the SLU enclosure.

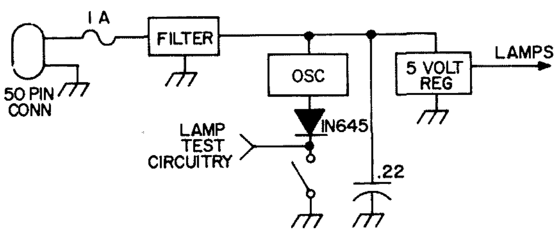

Fig. 15. Power distribution for the DTS.

The average power consumption of the SLU is 275 milliamperes at 12 volts; the quiescent power consumption for the DTS is 280 milliamperes at 12 volts (during lamp/oscillator test, the consumption increases to 630 milliamperes). When the DTS is connected to the SLU for monitoring the system's operation, the total power consumption is thus approximately 600 milliamperes at 12 volts. Variations on the order of 300 milliamperes occur as the various status lamps are lighted. Maximum power consumption is approximately 1 amp (12 watts).

Display Circuitry

Figure 16 shows a partial diagram of the lamp display circuitry. The 270 ohm resistors are used to bias the lamps so that they are normally dimly lighted. This is done so that the lamp driver integrated circuits will not have to endure the high current associated with a cold lamp when the lamp is initially turned on. The lamp drivers are essentially transistor switches that ground the appropriate display lamp.

The diodes are used to tie all of the lamps together for lamp test purposes. The diodes isolate the lamps during normal usage while permitting them to operate concurrently for test purposes. The tone oscillator, like the lamps, is enabled by supplying a ground signal. The detailed oscillator circuit is

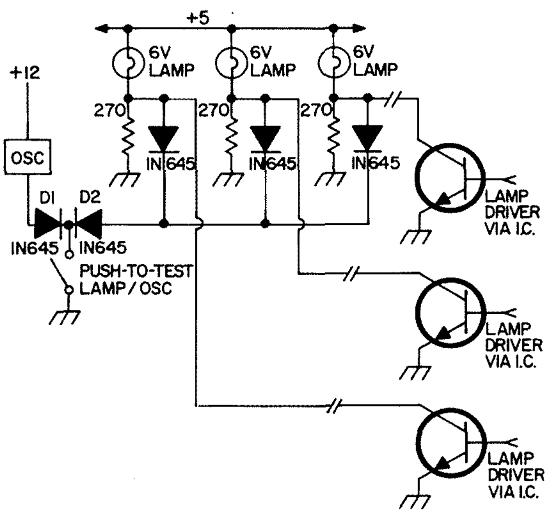

Fig. 16. Partial diagram of the lamp display circuitry.

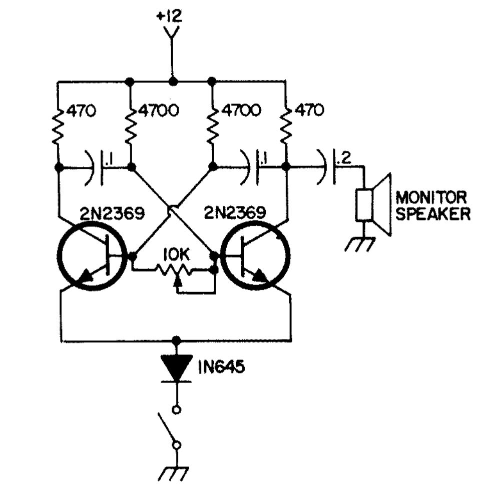

Fig. 17. Tone oscillator circuit.

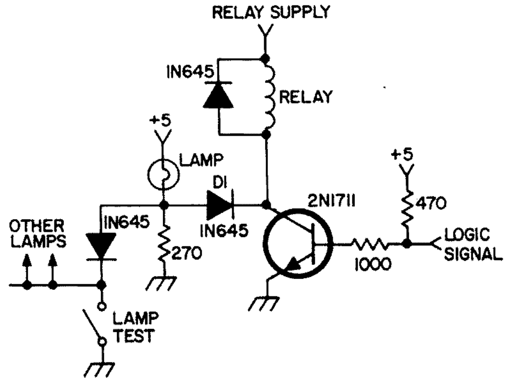

Fig. 19. The diode D1 permits system monitoring.

shown in Fig. 17. Diodes D1 and D2 allow a single switch to be used for test purposes with the 12 volt supply and 5 volt supply sharing a common ground return.

Lamp Drivers

The lamp drivers are essentially 2-input NAND gates with open collector outputs which function like conventional transistor switches (see Fig. 16). For each point in the logic to be sampled and displayed, a configuration such as is shown in Fig. 18 is employed. The transistor switch in the lamp driver is in parallel with the lamp test circuitry (diode and switch).

Formal Outputs

The formal system outputs (key transmitter, enable tone generator, switch audio input to transmitter, and connect telephone line) are already open collector switches and can be used directly for enabling the display lamps. However, so that the DTS can be used to monitor the system's normal operation, an extra diode is used to block the external relay supply voltage from entering the display circuitry. Figure 19 shows diode D1 connected to block the unwanted supply voltage. Failure to include the diode would allow the external supply to flow through the relay and into the display circuitry and associated power supply.

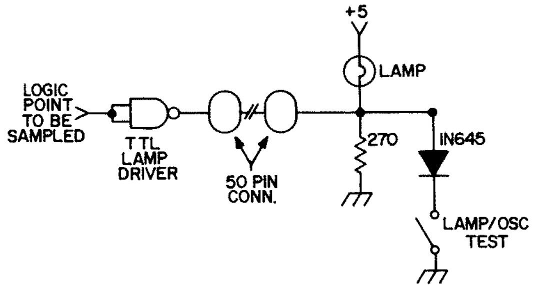

Fig. 18. Lamp driver circuit.

Conclusion

The foregoing two-part presentation introduces a repeater control system that offers many of the features frequently asked for by repeater users. The initial design goal was to create a small, reliable package that would provide a good repeater without an excessive number of components. Since this control logic was designed and built, the state-of-the-art has again progressed significantly; the diminishing cost of ROM memories, coupled with the announcement by Signetics of an I.C. timer, now makes still another "generation" immediately feasible.

I am currently pursuing a revised version of the system employing these newer devices. While the system described here was built using flatpacks mounted on "any board" and unijunction timers constructed on Teflon standoffs, the new system will be designed around the use of dual in-line packages mounted on a printed circuit board. The new system may also include, as an integral part of the logic, the Touch-Tone decoders and burst tone detector units. In the meantime, the existing system serves as a good starting point for any serious repeater group.

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AUDIO BOOST FOR MOBILE TRANSCEIVERS

Small portable VHF transceivers as well as some mobile units suffer from a lack of sufficient audio power output. This is particularly true of portable equipment when it is used in a mobile installation. The simple audio amplifier/loudspeaker unit described in this article was specifically developed to boost the audio output level of a portable transceiver. However, the circuit used has far wider application in solid-state receiver and accessory units. The circuit can be used as the complete audio section (preamplifier and power output stages) in a receiver and is also ideal for use as the audio section in a multitude of receiver accessory units such as outboard product detector adapters, audio selectivity units, etc.

Basic Amplifier Unit

The heart of the accessory unit, and indeed almost the entire unit, is a new microcircuit unit (hybrid integrated circuit unit, depending upon how you define such units) developed by Bendix Semiconductor, Holmdel, N.J. Designated the BHA-0004 and available for about $6, it is a complete audio preamplifier/power amplifier unit in a plastic case measuring about 1 x 2 x 1/3 in. thick. Certainly other integrated circuit af amplifiers are available, but what makes this unit unique is that it will deliver 5W continuous (not peak) power output using 12–14V dc, requires no heat sink of any sort and requires only a few external components. The high impedance input (20 KΩ) and low impedance output (3–8Ω) make for easy interface with a detector stage output and a loudspeaker.

Figure 1A shows the internal circuitry of the BHA-0004. Basically it consists of a preamplifier stage and a class B complementary audio power stage. The idle current and center voltage are preset for correct operation over a wide range of load conditions. A 20 mV maximum input will produce 5W output into 3Ω with a supply voltage of 12–14V dc. The distortion over the 300–3,000 cycle range is less than 1%.

Figure 1B shows the BHA-0004 connected up with its external components for use as an audio boost accessory. A very simple noise limiter circuit is shown being used ahead of the amplifier. It may, of

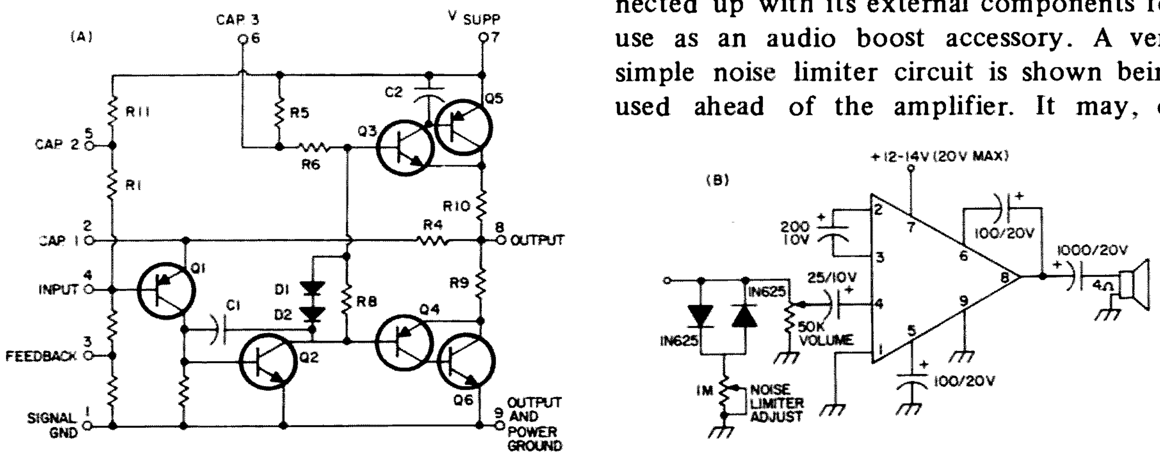
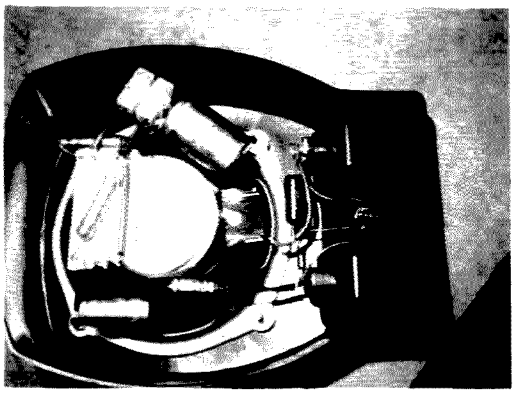


Fig. 1. Internal schematic of the BHA-0004 amplifier unit (A) and schematic of the amplifier as used for an audio boost accessory unit (B).

course, be eliminated for use of the unit as a straight audio amplifier. It was added because of the specific use for which the accessory unit was intended – operation of a portable transceiver in a mobile situation – since most portable transceivers do not contain noise limiter circuits. The capacitor values shown are not critical in an application where speech response only is required and similar units of perhaps as little as half the capacitance values shown may be used.



Construction

The photograph shows how the amplifier unit is mounted inside a simple loudspeaker enclosure. The BHA-0004 is simply fastened to the back of the loudspeaker face by epoxy cement. This method of mounting appears simple but is actually extremely secure. In fact, it may be undesirable in some cases since the unit cannot be removed without breaking it, other than by the use of special epoxy cement solvent. The capacitors are wired directly to the amplifier unit and between the unit and the potentiometers mounted on the loudspeaker enclosure wall. There are no adjustments that need be made to the completed unit.

Summary

The compacting and simplification of the audio portion of communications receivers has really reached a new point of development with units such as the BHA-0004. Aside from the extreme convenience in construction, the greater cost of separate solid-state components for similar performance alone augurs for the greater use of such amplifier units in amateur designs.

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LOW-COST POWER ON SIX METERS

For battery portable, mobile and emergency rigs, FM and AM.

This is a description of design methods, circuits, and components for homebrew generation of up to 5W (input) on 6 meters, for use with FM or AM, using reasonable cost transistors. A ½ to ¾W output is obtained from a crystal oscillator, followed by a parallel connected pair of Motorola HEP 75 transistors. These list for $2.95 amateur net, so you can see the truth of the low-cost mention.

The output can be pushed to equal that of the famous Gonset Communicator series, and nothing stops you from adding a couple more 75's, using the described methods, for a 10W rig.

The actual specs furnished say "total dissipation, 3 watts". That's for *each* transistor! You're out of the dry cell class then, but the Globe Co. has remarkable non-spillable lead oxide storage batteries that will surprise you, for portable and emergency work. So here are the details.

The Motorola HEP 75

In a box of goodies recently received from Motorola were some HEP 75 transistors which are the HEP low cost version of the famous 2N3866, the solid state "Little Five Watter" for VHF and up into UHF. The real test was soon applied by soldering one in on 432–450 MHz in the place of a 2N3866, and sure enough it showed up equally well. Since that day I have used them for added power in a variety of places from 50 to 450 and they have all worked like the 2N3866, so here we go with details of how to add a 5W amplifier to your present 6 meter FM or AM solid state portable rig.

The One Watt Crystal Oscillator

Time was, in the good old tube days, you could run a lot of power out of a crystal controlled oscillator. The Taylor Tube Co. once advertised a crystal circuit, using exactly two tubes (Taylor, of course) that ran one KW (one kilowatt) dc input to the final. CW that was. These days control crystal manufacturers seem very reluctant to say just how much milliwattage you *can* run through their thin little pieces of quartz. So, unless or until they come up with a definite figure beyond "two or three milliwatts," we're on our own for awhile.

It's all very well for them to say "a couple of milliwatts" but if you pursue this policy down the line, and up in frequency,

you can end up with a lot more transistors, amplifier stages, coils, and other components, than you originally planned on, as well as having spent more time, dollars, and cerebration than absolutely needed. Let's see what can be done to push the power per stage a little with these $2.95 devices with their 3W dissipation figure.

The schematic (Fig. 1) shows my favorite crystal oscillator starting out in the 1970 decade which runs one of these – the lively, always ready to go – HEP 75-2N3866. There is a slight difference in the specs on the HEP 75 and the RCA 2N3866, this latter rated at 55V and the former 20V. So for an AM rig watch out for that collector rating under modulation which can double the battery dc voltages.

Recently, needing maximum power in a minimum package (always an interesting idea!) I kept pushing the 50 MHz oscillator power up and up until there was over a watt going into it and over ½W coming out, which was driving the final in great style. Remembering the old trick of putting a pilot light bulb in series with the crystal, I soldered in a No. 48 bulb, as can be seen in Fig. 1, and sure enough, it lit up. Just a dull red glow, but checking with the "Amateur's milliwattmeter" I found between 10 and 25 mW, depending on the tuning and output loading, as well as the battery voltage. This can also tell you interesting things about the oscillator such as how much of the generated power is being devoted to feedback and how much to the next stage.

Just how much power can you run through these VHF crystals? Recalling those not-so-long-ago (the late 1950's) tube days when over 100V and 20 mils to the plate of the oscillator brought on crystal instability, I pushed the oscillator under test still further, first making sure I was not using one of my favorite crystals. The oscillator output came up to ¾W at 50.2 MHz, and the rf showing in the bulb in series with the crystal indicated about 20 mW. So far, no frequency shifts, noise, power jumps, or other noxious conditions have shown up. You can leave the crystal current indicator in or not, as you please. I checked the output with the bulb in and out and you can just see the difference, of some 15 mW out of perhaps 500 or so.

I just checked once again on the stability by listening to the carrier on my lab receiver which has a reasonably narrow bandwidth, and everything sounds fine. A good, solid "plunk" is heard when the oscillator is tuned in from one side, using L1 and C1 of Fig. 1, and an even, gradual climb on the other.

Incidentally, the coil being used just now is one of those tiny Piconic Co. jobs, the BK121K713Y1, less than 1.8th in. thick, so it's evident that you can pack the whole oscillator down to a real small size.

The emitter circuit as shown allows you to choose the power and current you want, and then put in a single resistor of the value found. The power control with R1 is very smooth as it should be. Check the output coupling very carefully when the oscillator is running and loaded with the amplifier input, because it is easily possible to overload it and keep it from starting up, even though it is a very good oscillator.

That about winds up the oscillator details. It is quite easy to assemble, and is not critical or touchy at any point.

The RF Power Amplifier

With the crystal oscillator bowling along nicely at ½ to ¾W output what will the amplifier do? The schematic, Fig. 2, shows the circuit, which runs smooth as silk and started off with a watt and a half output right away. The layout is shown in Fig. 3. After a number of tries in paralleling the

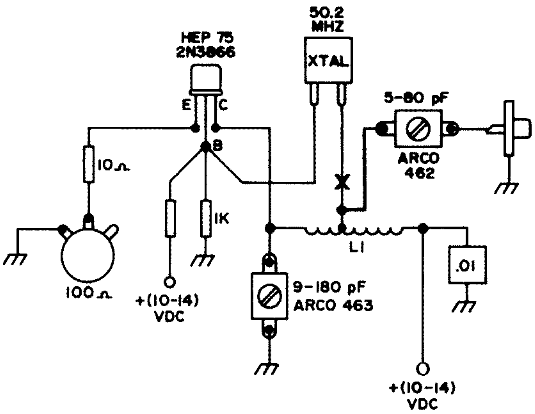


Fig. 1. Pictorial view of the oscillator schematic. For tuneup purposes, insert a No. 48 bulb at point "X" in the crystal lead. The resistor connected from the base to +(10–14V) should be 4.7K. L1 is 10 T No. 22¼" diameter with the tap at 4T from the collector end.

HEP 75 transistors, with wires, soldering to the cans, etc., – not all successful I must admit, with some trouble from overheating when soldering the cans onto the relatively heavy copper strap of L1 – I took a little time to work up a mechanical paralleling holder which did an excellent job immediately and can be modified to hold not only two transistors but three or even four. This simple little plank is shown in Fig. 4 and is made of copper clad stock. If you want to be real fancy and obtain better heatsinking at the same time, use a piece of copper of some thickness, such as 1/8 in. Heat is a *bulk* effect and is conducted away faster by a *thicker* piece of metal. Notice the machine screws tapped into the copper clad, which allows insertion of the transistors *after* soldering to the copper strap of L1. This avoids excessive heat on these devices which, even though made of silicon and able to stand a certain amount of soldering, I'm beginning to think do not really appreciate such treatment. In fact, I'm going to keep my iron away from them in the future. After all, that little plank shown in Fig. 4 can easily be skinned down to very small size if needed for higher frequency. As mentioned, you could easily put three, or even four in the circuit. I started out with a pot in each emitter circuit but found nothing critical there either, so I don't think it is necessary to have adjustments for each emitter, although it is always interesting during tuneup to have a few more knobs to twirl.

The collector circuit is well tapped down on L1, as you can see, and has always behaved perfectly, tuning at very close to the same place on the 100 pF variable capacitor C5, of Fig. 2. The combination of a copper strap inductance, the groundplane, the shield wall, and the low-impedance collector tap all make for a good Q, which shows up in the good handling of the resonance curve of L1.

The output circuit is the usual series capacitor, also tapped down on the inductance L1, and is well able to variably load both test bulbs and 50Ω cables.

After you get the breadboard amplifier running properly in the size shown, you could think about installing it in a minibox. For instance, substitute a much smaller coil

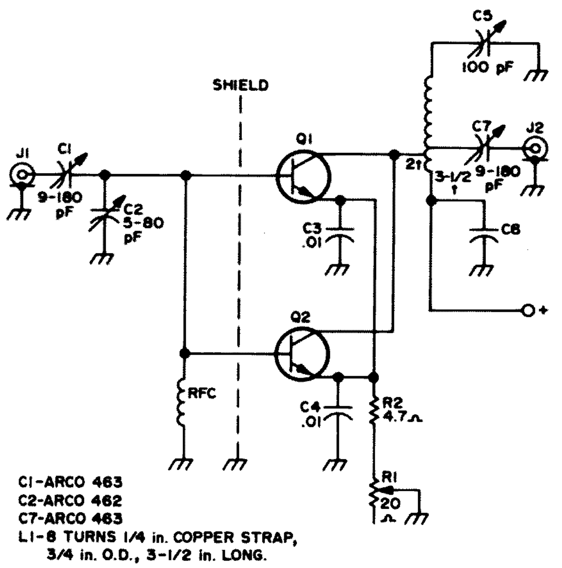


Fig. 2. Schematic of the 5W amplifier. The rfc should be approximately 7–10 μH. C6 is 1000 pF disc ceramic. Q1 and Q2 are HEP 75's.

for L1, which is the largest component, being sure to check it for output power when you do, and you could put in a Johnson type M variable which is only 5/8ths by ¾ in. in size, plus a fixed capacitor as needed. And test them *first* on the breadboard as shown!

Tuning Up

This should include voltage tests, current, frequency checks, and output. Hour after hour get used up on the bench with this sort of work, but it's fun and if it also saves *you* time, well, that's fine with me.

I often think – having been in "radio" for over half a century now, that if I have trouble tuning up these little beasties, what will the beginner do? Well, if he reads this he can at least overcome the troubles I found.

The first thing in tuning up is to get some drive into the amplifier base and start building up current from that. Actually, there are two coupling capacitors shown, and you really only need one. These are C2 of Fig. 1, and C1 of Fig. 3, which are seen to be in series when you connect the oscillator to the amplifier. If you leave them on two separate planks this is handy sometimes for cable matching, but if you mount these units on one baseboard you only need one coupling capacitor.

There being no dc bias on the amplifier base you rely on the oscillator drive to turn on the amplifier, and there is plenty of drive there to do this. As soon as you begin to get collector current you start in on the main tuneup job, most of it being concerned with obtaining a good match for the collector circuit, a matched load, and checking for resonance in L1. Be very sure you are not tuned up on a harmonic. It's not too likely but it can happen.

Build up the drive and collector current a little cautiously, using C1 of Fig. 2 and working with R1 to adjust the current. Generally you will not be able to push (via drive and R1) the current up to the full 350 mils, or perhaps 400, until everything is matched and tuned. You may notice a buildup and then a drop in rf output as you push the current up, before you reach the happy condition of having everything going right. This is why you generally see a variable resistor in most of my emitter circuits, at least for breadboards.

The oscillator drive you need should also be adjusted with R1 of Fig. 1, along with the

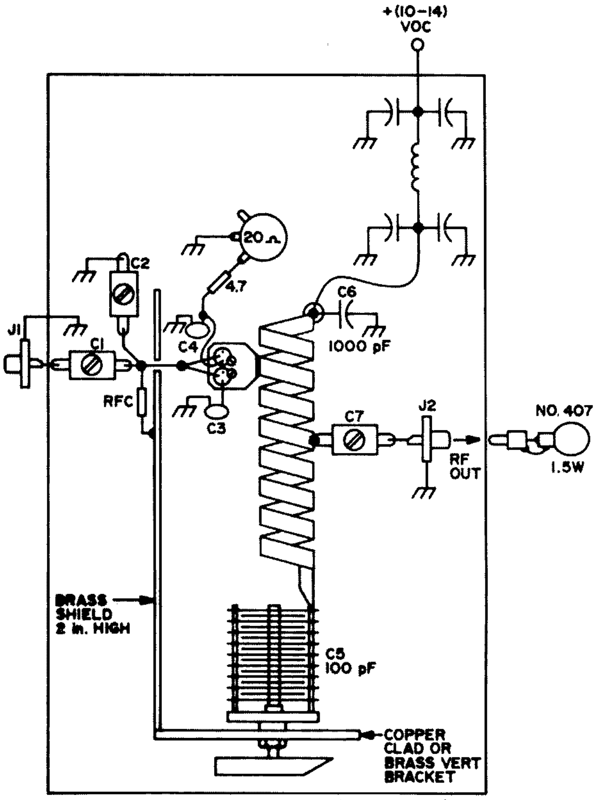


Fig. 3. Layout of the 5W solid state 6 meter amplifier. The rf decoupling network between the amp and +12 can consist of 4 .001 disc ceramics and 50T. No. 28 on a ½W resistor.

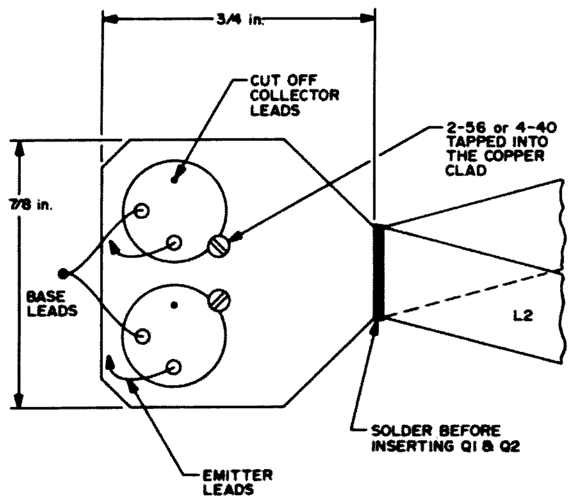


Fig. 4. Parallel adaptor for HEP 75 transistors. The material can be copper clad; or for better heatsinking, solid copper. Drill the holes for the transistors for a tight fit and lock them into place with the machine screws.

oscillator output coupling capacitor C2. After a little playing around with these controls, and the others on the amplifier, you will get the hang of it (with luck) and find your output climbing toward 2W or even a little more. You can add another 407 bulb to check the output power. Use a separate series matching capacitor for *each* bulb, and check loading, possibly using the output tap at three turns, or even two turns, instead of at four as shown, because the impedance of two loading bulbs in parallel is naturally lower than one only. About this time also, keep checking the temperature of Q1 and Q2. Putting your finger on them after running a few minutes will do for a start. If you can keep your finger there, you're all right. If you wet your finger and it sizzles, that's not so good! Several small drops of wax in a line running from the transistor case over the paralleling plank and onto L1 can tell you quite a story about your heatsinking! Of course you don't *have* to run 5W to them, and you can also parallel four instead of two, as mentioned. Rated dissipation is 3W each, and with an efficiency of around 50% you should do all right at 5W total for the two.

For output indication I have been using the 1½W No. 407 bulbs lately, which show up well as an easy-to-match rf load, and work even up to 450 MHz, except for the fact that they are the flashing type with a bimetal contactor *inside* the bulb where you can't get at the darn thing to choke it off! As soon as this pesky little strip in the bulb warms up it begins to turn your load on and off at about one second per click. The story is that not all bulbs load up well with rf, but this one does. Hope to find time soon to test a bunch of them for you. On 450 MHz by the way, use as little as less than 1 pF for the series matching capacitor to ground. That is for the pilot light bulb No. 407 used as a test load and rf indicator for output.

Once again, when everything is tuned up and matched, the oscillator inductance with the crystal, the proper amount of oscillator drive into the amplifier base, L1 tuning correct, amplier collectors fastened properly and matched, the whole assembly is so stable you can put your finger on the hot end of L1 and the bulb will still light, although it will be less brilliant of course. I use a switch to throw in two lantern batteries for about 10V (after a few days) and three of them for 14.5V. This simple battery-saver scheme is quite useful for local contacts.

Hope you have as good luck with your tuneup.

Power Considerations

We're now getting up into the battery drain which is near the practical and economic limit for dry cell batteries. The usual "lantern" batteries are rated at 500 mils (½ an ampere) by Union Carbide, with some of the heavier ones going up to 1A, so with 14½V on the final, and the class B modulator still to be reckoned with, if you're on AM, the next step for portable power looms. As far as I'm concerned this is the lead oxide battery of the Globe Co. It is non-spillable and maintenance-free, and you can draw 40A from one of them without damage (to the battery, that is!). This kind of power from a portable battery begins to make our dream of a 25W jacket-pocket rig realizable.

Well, if two transistors in parallel are better, how about three or maybe even four? (I'm reserving the push-pull parallel job for my 25W dream rig.) Also, high powered transistors can be brought into play if they're not too high also in dollars.

...K1CLL

Wayne Green W2NSD/1
Editor-Publisher

HAND TRANSCEIVER MADNESS

Did you know that Motorola has the name Handy Talky all sewed up – and that includes Handie-Talkie or any similar deviations? Bless Motorola and their lawyers who are trying to preserve this most descriptive term from public use.

Most of the early ham band transceivers were Motorolas, whether they were rebuilt seconds from the production line which had fallen into amateur hands or merely stolen units which mysteriously surfaced at hamfests and conventions. Some of them worked pretty well – others remained the seconds they started out.

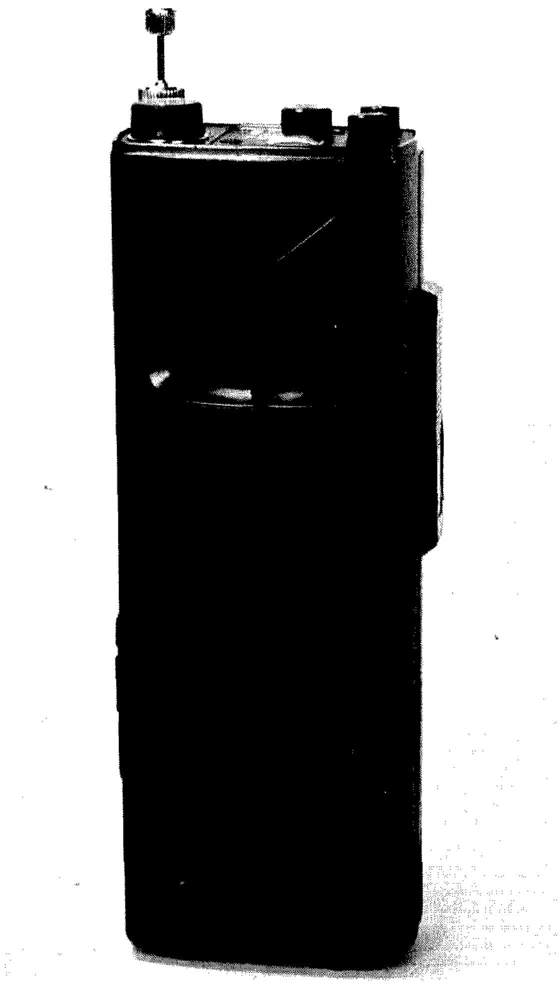
The main source of these HT boards and parts has been Art Housholder, the chap who runs Spectronics (Illinois) – and who has a multi-million dollar inventory of stuff from nearby Motorola. Art seems to always have a few HT's in his pockets ready for sale.

The result for the amateur has been that he could get together with Art at a hamfest or convention and buy a complete HT-220 transceiver for about $275 that would cost perhaps double that or more if bought from Motorola directly. This is why there have been so many HT's at hamfests and conventions – hams know a good deal when they see one. This is good for Motorola, too, for it provides a way of getting something for HT's that otherwise might not be satisfactory – there is no evidence to indicate positively that fresh new HT's are being sold through this system, though it would seem that they could be moved along at that price and still make a profit, since the high cost of commercial selling and commissions would be eliminated. This might run Motorola into trouble with commercial customers and maybe even the government – isn't there some rule against selling the exact thing for two different prices?

Hams have benefited greatly from the flood of HT's. Thousands upon thousands of them are now everywhere wherever hams get together. Channel 94 sounds like a CB channel at bigger conventions.

The more serious FMers latched onto HT's early in the game and they keep them at hand day and night. There are more repeater owners than you might think who sleep with their HT's more than they do their wives.

Picture yourself as the proud owner of a new repeater – walking along in the local shopping mall with one HT on each hip – volume turned up high and squelch on. You leave your ham buddies for a minute to go through a crowded restaurant to the rest room in the back. Just as you are in the middle of the place one of your friends breaks through the repeater with, "Which way is the toilet?" About one hundred people suddenly are completely silent as your face turns bright red and you spin around and head out as fast as you can.



The Standard 146A is a 5 channel unit that runs 2 Watts output.

Varitronics came out with an HT-2 shortly before disappearing into the woodwork, leaving a lot of customers and others screwed. The rig was nice, but the shock to the Japanese manufacturer was so severe that he has only just recently been trying to sell to the U.S. again. Pity, for the gear is great.

The next hand transceiver to come out was the Standard 146. This five channel job with one watt out was priced competitively with the HT-220 at $279. It was about the same size as the HT-220 with the Omni case – the one used for the five watt model or the six channel two watt model, but was a little longer to allow room for the nicad penlite cells instead of the special (and extremely expensive) nicads required by the HT. The 146 also used the regular HC-25/U cyrstals instead of specially made crystals which have to be soldered into place. Changing crystals in the HT's is so difficult and so expensive that it is normally avoided in every way possible. The 146's can be changed to new channels in a minute or so – and they use the regular Standard 826 crystals which are in stock at most dealers.

The provision for an external mike on the 146 made it very nice for hamfests where it can be worn on a belt and the mike hung on the case when not in use.

The introduction of the 146A resulted in dealers selling off their stocks of 146's for around $220, certainly one of the best bargains seen in amateur radio in recent years.

Standard Communications got into a bind for a while when the deliveries of automatic battery chargers got way behind the 146 deliveries. Fortunately it turned out to be very simple to charge up the transceivers and the chargers were not badly needed. The nicad cells plug into a battery holder, which in turn snaps into the transceiver with ordinary battery connector such as is used on 9 volt transistor radio batteries. Any twelve volt power supply can thus be used to charge the nicads. The battery pack comes out of the 146 in two shakes and snaps onto the twelve volt supply.

Now that Standard chargers are available in quantity it is a bit easier – you just set the transceiver into it and snap the switch to normal charge or trickle charge.

The newest hand unit has just been announced by Henry Radio – with the first ad being in the December issue of 73. This one has six channels – plug in crystals – uses regular nicad cells – is made of very light weight (but strong) material – runs two watts out (three watts when fully charged) – and is almost exactly the same size as the Standard 146A. Henry is selling the Tempo/fmh for $189.

One other company is also importing the KP-202 hand units – the same rig Henry is selling – and this is Grove Electronics. They are small and were advertising for a while only in the Repeater Bulletin. Recently they have joined the ranks in *73*. They have the advantage of having a full set of accessories available for the unit – short rubber whip with the special antenna connector on it – a set of ten AA nicads – a leather case – and, best of all, a $25 charger unit with a timer built in for fast or slow charging. The Grove nicads can be fully charged in three hours with this system. Grove is selling the whole bundle – transceiver – nicads – rubber and regular telescoping antenna – case and charger for $270.

Some of the other manufacturers of commercial hand transceivers might do well to take a closer look at the Motorola system for moving seconds. The GE, Bell & Howell, Sonar, Hallicrafters, Johnson, etc., are all good units, but out of reach of the amateur. The amateur market for hand units has just been scratched.

Those amateurs using hand transceivers have been having a fabulous time. Some have been using them for such esoteric achievements as making horseback mobile contacts – skiing mobile – kiddy car mobile – skateboard mobile – ice skate mobile – swivel chair mobile – etc. The latest FCC regulations dictate that a hand unit be called mobile, wherever it is used, even in bed.

One and two watt hand units will usually get into a repeater just fine if it is line of sight. Repeaters such as W1KOO on Mt. Mansfield pull in hand units from 50 or more miles out with ease, enabling contacts over 150 to 200 mile paths to higher powered mobiles in Ontario from the northern parts of New Hampshire.

The term "Walkie-Talkie" is not registered and this is safe to use with any hand transceiver, being beyond the grasp of Motorola and its horde of lawyers. Generally the larger transceivers are thought of in this context – units such as the Drake TR-22 which is more of a shoulder strap rig than a hand-held.

The TR-22 is a very good deal, really, selling at under $200 and having its own self-contained batteries (nicads, usually), with built in charger, six channels, etc. This one watt rig has astounded thousands of delighted users with its coverage.

Another very similar unit is the Tempo/fmp, with eight channels, plug in whip antenna, battery pack that unsnaps, hi-low power switch (3 watts max), and other features. This sells around $225 with battery pack.

Amateur ingenuity can be used to convert some of the smaller transceivers into walkie-talkies. The Ross and White is ideal for this, with its power saving 10-1-0.1 watt switch. In the car you switch to 10 watts – on the shoulder to 1/10th watt, with 1 watt available in times of need – or even 10 watts, if your battery will take it. This has twelve channels too.

The application for hand units is unlimited. Once you have one you find that you are using it a lot of the time. If you have much in the way of ham friends you will find yourself using rigs for talking between cars on trips – for keeping in touch when you are walking around a town separately – for checking out other gear – club meetings – in restaurants to show off to non-ham friends – on hunting trips (this can be bad if you are using a repeater channel as your rig will suddenly start making a big noise just as a deer is in sight and that will blow the whole thing). If your wife is licensed you can use your rigs in place of CB gear so she can remind you of things she needs when you are at the store – or she can tell you about non-business calls – there are just too many applications to cover.

. . .W2NSD/1

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QRP ON 180 kHz

An old amateur band revisited.

While browsing through FCC Rules and Regulations governing low-power communication devices, Part 15.203 caught my attention. The FCC radiation limit placed on a low-power device operating between 10 and 490 kHz is determined by dividing a constant (2400) by the frequency in kilohertz. This yields field strength in microvolts per meter at 1000 ft from the device. For 240 kHz the computed value would be 10 μV. Part 15.203 allows the use of 1W maximum plate input power to a communication device operating between 160 and 190 kHz. Although plate power is increased, a limit is placed on the length of antenna. The antenna cannot exceed 50 ft total length as measured from the plate coupler. The lead-in or transmission line must be counted as part of the antenna.

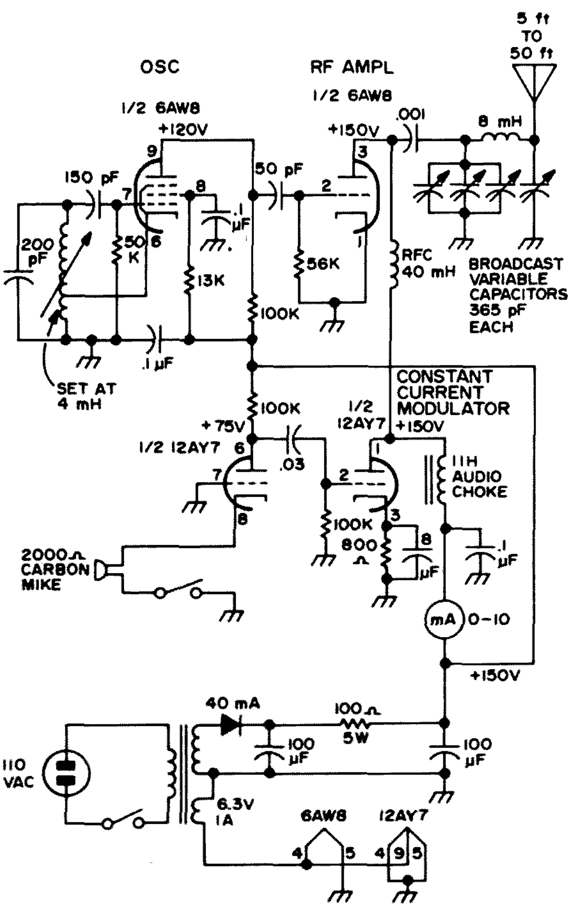


Fig. 1. Experimental rig for tests on 180 kHz.

QRP rigs have always interested me, and this challenge in the low frequency bands could not go unaccepted. I built the rig shown in Fig. 1 and tested it for distance with the friendly assistance of Bill Hansen (WA5JVY) and Bill Baird (W5GXU). With short antennas, such as 5–10 ft connected to the pi network, the local coverage is good even though my QRP rig is working at about 500 mW instead of the allowable 1W. Three distances were tried: 10 miles, 2 miles, and 1 mile. The only distance from which I could receive a signal was 1 mile and under.

Many factors enter into the distance at which reception is possible, and a full discussion is beyond the intent here. Factors pertinent to a distance test are contained in many textbooks and in other excellent sources from which notes have been compiled over a number of years. In those years no thought was given to publication. It is regretfully impossible therefore to list sources or give deserved credit inasmuch as my notes are incomplete. However, these examples from my notes

will help to illustrate some of the principles which govern transmitting and receiving rf energy.

The free-space transfer of power between two antennas *depends upon the number of wavelengths between antennas* rather than the numerical distance. The energy available at a common receiving location for 500 kHz and 50 MHz can be compared when the effective radiated power at the transmitter is 1 kW and the distance, in this example, is about 18.6 miles (30 kilometers).

$$\text{Wavelength} = \frac{3 \times 10^5}{\text{freq in kHz}} = \text{meters}$$

Therefore, 500 kHz = 600 meters

50 MHz = 6 meters

(one wavelength for each frequency)

$$\text{Separation is: } \frac{30{,}000}{600} = 50 \text{ wavelengths}$$

$$\frac{30{,}000}{6} = 5000 \text{ wavelengths}$$

$$\text{Then, } \frac{\text{Power Received}}{\text{Power Transmitted}} = \frac{P_R}{P_T} = \left(\frac{.119}{n}\right)^2 = \text{watts}$$

where n is number of wavelengths between transmitter and receiver.

By substition,

$$\frac{P_R}{1000} = \left(\frac{.119}{50}\right)^2 = 5.6 \text{ mW for 500 kHz}$$

$$\frac{P_R}{1000} = \left(\frac{.119}{5000}\right)^2 = 0.56\ \mu\text{W for 50 MHz}$$

Remember, these are examples for the same physical distance and serve to demonstrate why receivers for high frequency and VHF generally have high-gain front ends and why broadcast band receivers can get by with a mixer stage coupled to a self-contained loop antenna. Bringing the 6-meter signal up to the 5.6 mW level would require about 40 dB of amplification. Furthermore, to build each of these signals to about 600 mW at a detector would require about 20 dB amplification for the low-frequency signal and 40 + 20 dB for the high-frequency signal. That is a respectable amount of amplification and becomes a reason why several i-f stages are to be found in HF and VHF gear.

Rf power passing through a free-space area does not depend on frequency. The amount available can be stated in watts per square meter by using this formula:

$$\frac{3\,P_T}{8\,\pi\,d^2} \qquad \begin{array}{ll} P_T & = \text{watts transmitted} \\ d^2 & = \text{meters from transmitter} \end{array}$$

But, the power available to the receiver is dependent on frequency because the effective area for capture of rf energy by the receiving antenna is dependent on wavelength. The power available to a receiver is:

P_R = watts/square meter X the area (effective)

Without going through the calculations, let me jot down from my notes several approximate values for *effective areas*:

Half-wave antenna
0.130 x (wavelength)^2

Short Dipole 0.119 x (wavelength)^2

Short vertical near earth
0.059x x (wavelength)^2

For the 500 kHz case we have: $(600)^2$ x .119 = 43,200 square meters and for 50 MHz it becomes $(6)^2$ x .119 = 4.32 square meters.

These effective areas for capture illustrate another fundamental reason why HF and VHF enthusiasts put up beams or literally "hang out more wire" to improve the signal strength before it is passed on to the receiver.

Now to get back to the low-frequency, low-power tests. The tests we made were over poor, dry soil, with at least one canyon between transmitter and receiver. In addition, the antennas were randomly oriented with respect to one another. Making all the same calculations for our test, 1 mile comes close to being 1.61 kilometers and the wavelength of 180 kHz is close to 1667 meters. Therefore, since this discourse is illustrative, I'll beg the rigorous issues and say that for this case:

$$\frac{P_R}{0.45 \text{ watts}} = \left(\frac{.119}{1}\right)^2 =$$

$$0.45 \times .014 = 6.3 \text{ mW}$$

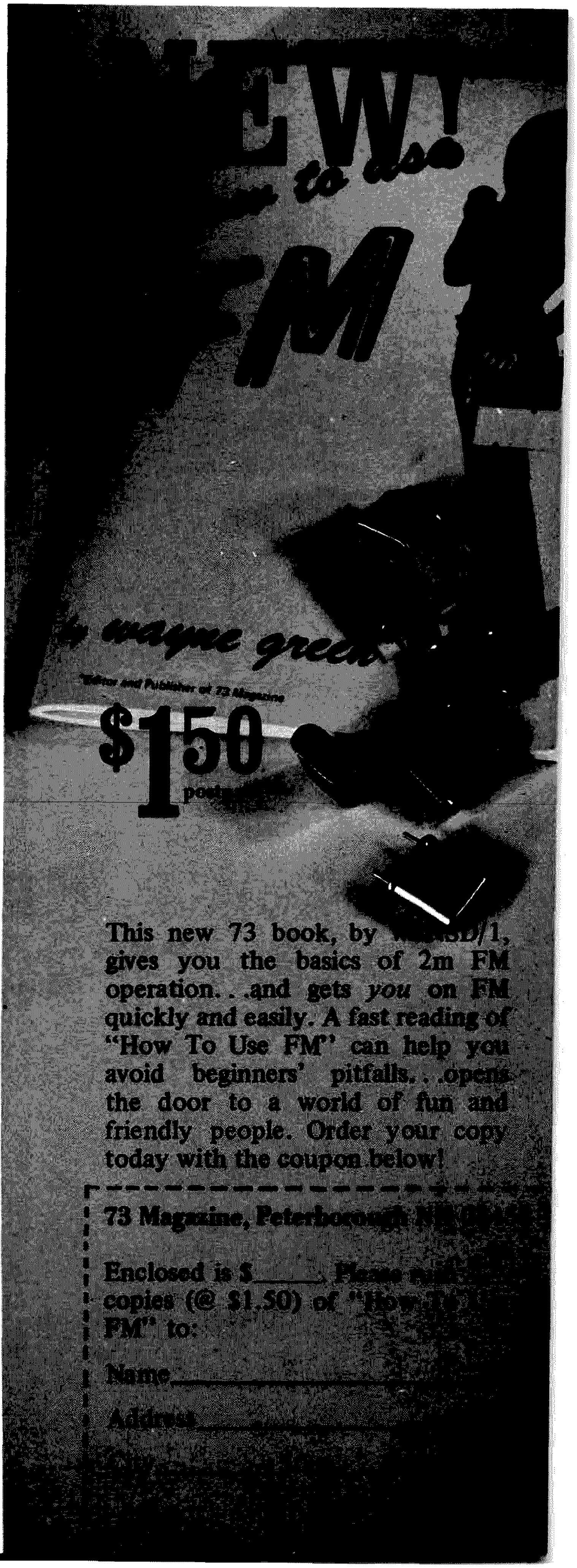
Which would be a respectable signal if our transmitting antenna were efficient and all of the power was radiated. The hooker is the 50 ft limit on the antenna. It is extremely short compared to a half-wave and the efficiency of radiation is decidedly low. The poor soil and randomly oriented antennas didn't help matters. I felt we were fortunate to hear anything from the QRP rig at 1 mile. An old surplus Navy RAK-7 receiver which has two stages of rf amplification ahead of an oscillating detector apparently made the difference. No effort was made to match my 160m inverted-L station antenna to the RAK-7.

There isn't much need to elaborate on the QRP rig. It was built from junkbox parts. A 6U8 tube would have been preferable over the 6AW8. The former has a rapid heat-up filament. The oscillator is an electron-coupled type which affords a measure of isolation and minimizes frequency shift due to modulation. The rf amplifier is self-biased in order to make the most of the available drive. The 40 mH choke in the amplifier plate circuit is nearly self-resonant to 180 kHz. The pi network was selected to load a 50 ft piece of wire reasonably well in the face of a 50 kΩ plate impedance. The modulator is a constant-current type and matches the impedance of the rf amplifier fairly well.

Any other microphone preamplifier will work in place of the one shown. I happened to have a surplus carbon microphone which has 2 kΩ resistance. The power supply is of the small preamp type and happens to be the limiting factor for the power input to the final amplifier. Modulation was less than 100%; however, we had to resort to CW for the 1 mile test so that didn't matter.

This experiment made it obvious why CB equipment is designed for use in the 11m and higher frequency bands. A small transistorized 1W 180 kHz transmitter and receiver would not be hard to build, but, that 50 ft collapsible antenna would be something of a problem!

... W5SOT



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SOLID STATE AUTOMOBILE BURGLAR ALARM

A unit that triggers a state of alarm when approached by a burglar! The alarm automatically resets itself after 1½ minutes and is ready for the next thief.

Looking at the prices for car burglar alarms these days, one wonders if it's really worth the $30 or so they cost. Recently a friend of mine asked me if I could build an alarm for his car, as he was worried about his new tape deck. As a result, I built this alarm in a few evenings. It's solid state, except for one relay.

The alarm is actuated by the standard door switches used to turn on the dome light. It uses the horn in your car as the alarm, thus saving the expense of purchasing an auxiliary horn or siren. If you are worried about the alarm discharging your battery too much, forget it: a built-in timer shuts it off after about a minute and a half, and resets it. It's simple enough to build in a couple of evenings, and most of the parts are inexpensive and non-critical.

A look at the block diagram will clarify the basic operation of the device. When the triggering terminal is brought to ground potential, or near it, the gate latches and supplies power to the alarm circuit. The triggering terminal is connected to the door switch. Once the gate is turned on it becomes independent of the triggering circuit. Thus, if the door is closed a few milliseconds after it is opened, the alarm will still sound off. The timer then starts, and the unijunction pulse generator starts producing dc pulses at the base of the relay driver stage. The relay will then open and close with approximately a one second cycle. The relay can be connected in parallel with the horn button, or wired directly in series with the battery and horn. After about one and a

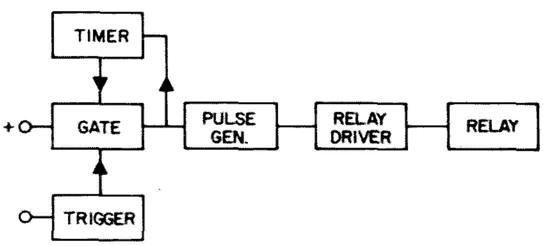


Fig. 1. Block diagram

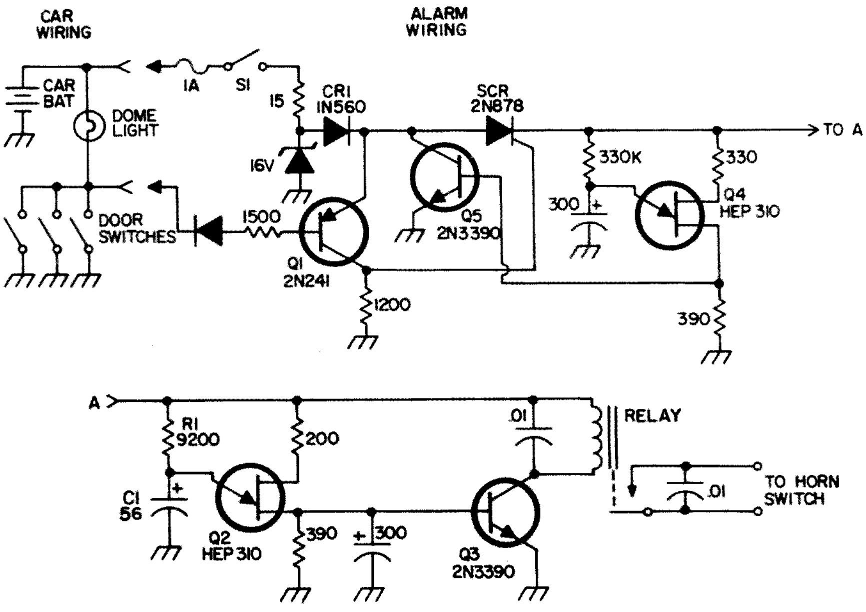


Fig. 2. Schematic diagram of the alarm.

half minutes, the timer will turn off the gate, thus turning off the alarm. A relay was chosen for the horn control rather than a transistor because in some cars it must switch over ten amperes, and a relay is cheaper.

The schematic shows in detail how the thing works. Starting at the battery terminal, the 15Ω resistor is just used to limit the overall current through the alarm, in case of a short circuit. The zener diode is used to clip off any transients that might be present in car wiring, such as those caused by turning on the lights or the horn, and which could damage the transistors. The operating voltage rating is not too critical, and can be anywhere from 16–30 volts. The rectifier, CR-1, is just to protect against damage resulting in improper battery polarity when wiring it in the car.

The silicon conrolled rectifier is the latching device used to turn the alarm on. In order to conduct, it requires a positive voltage at its gate. This is provided by the voltage drop across the 1200Ω resistor when Q1 conducts. When the triggering terminal is grounded, the base of Q1 is negative with respect to the emitter, thus it conducts. Rectifier CR-2 is used to keep a positive voltage off the base, as its cathode is normally at +12 volts. The 1500Ω resistor limits the base current.

When the SCR conducts, a voltage will build up on C1. When it reaches about 8 volts, Q2 will conduct, producing a voltage drop across the 390Ω resistor. The voltage across C1 will then drop to about 5 volts, and it will start charging again through R1. A positive voltage at the base of Q3 will allow it to conduct, closing the relay contacts. The .01 capacitor across the relay coil helps to reduce voltage transients that could destroy Q3. The timing circuit is basically the same as the pulse generator, but with a much greater RC time constant. The 300 μF capacitor must be of high quality, with high leakage resistance, or the circuit will not operate properly. When Q4 conducts, it produces a voltage drop across the 390Ω resistor, thus allowing Q5 to conduct. Q5 effectively bypasses the SCR, making it stop conducting, and turning off the alarm. It's a quick and dirty way to shut it off, but works well.

The components used are strictly junk box parts. The relay should be able to switch ten amperes and should pull in reliably at ten volts dc. The unijunction transistors are Motorola HEP 310's, commonly available at electronic parts stores. The transistors can be almost any small signal types, observing of course the difference between NPN and PNP types. I used one ampere rectifiers for CR1 and CR2. The SCR is a 2N878. It can be

purchased from a local Allied-Radio Shack store in one of their plastic blister packs.

Installation of the device is not very difficult. Switch SI should be a key operated type, easily obtained from most electronics mail order houses. The relay is best connected in parallel with the horn button of the car. The alarm unit itself should not be mounted in the engine compartment, as there is arcing across the relay contacts. Any gas fumes present when this happens, and it's all over. Besides, a box would have to be weather proofed in order to protect the relay contacts and other components.

Power for the device can be obtained from an unswitched accessory fuse terminal. The main power cable from the battery should be run through some BX cable, as well as the wire going to the horn, in order to discourage a thief from cutting the wires. By obtaining a couple door switches from a junk yard, one can make a bracket and mount them in the hood and trunk. They should be connected in parallel with the other door switches.

I found that one of the most useful aspects of this project was that it was a painless way to learn about the various operations of a unijunction transistor. It certainly is a good "first project" for someone who doesn't have much experience with solid state construction.

Various additions could be made to the basic unit. A time delay unit could be built that would allow the ignition switch of the car to be used for the alarm actuating switch. When the ignition is turned off, one would have fifteen seconds or so to leave the vehicle before the alarm would arm itself. Upon entering the car, the alarm wouldn't sound for another fifteen seconds, allowing ample time to put the key in the ignition. On the newer cars, some type of circuit could be designed that utilizes the 'key-still-in-ignition' idiot buzzer switch.

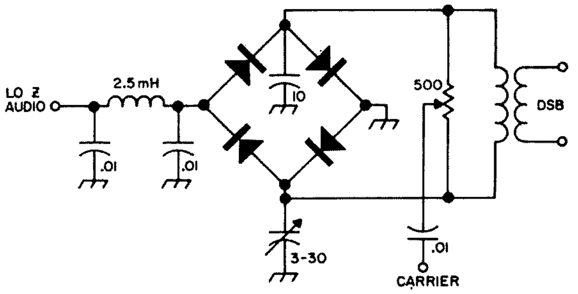
I will be happy to answer any questions, as long as a SASE is enclosed. Remember, one of the best ways to insure the safety of that mobile rig is to not tempt the potential thief. Keep your doors locked, and if possible, remove the rig from the car when not in use.

. . .WA1KON

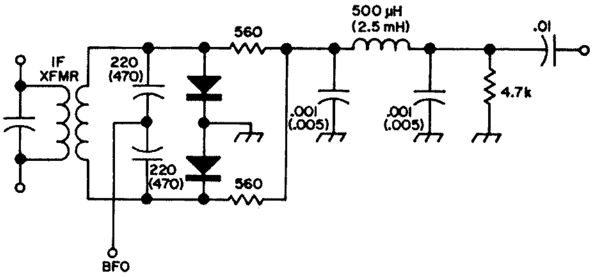
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

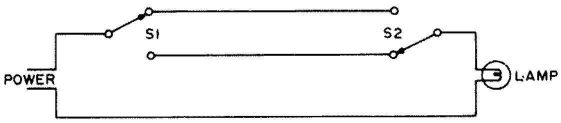
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



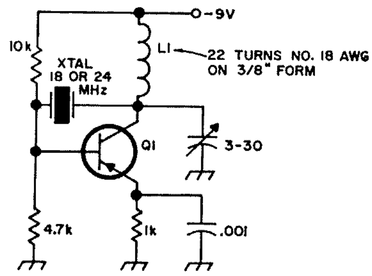
A bridge balanced modulator for generating a double sideband-supressed carrier signal. Match the diodes as carefully as possible – any surplus diodes will work – and use symmetrical layout when assembling. The primary of the coil should be a few turns around the secondary, which is resonant at the carrier frequency.



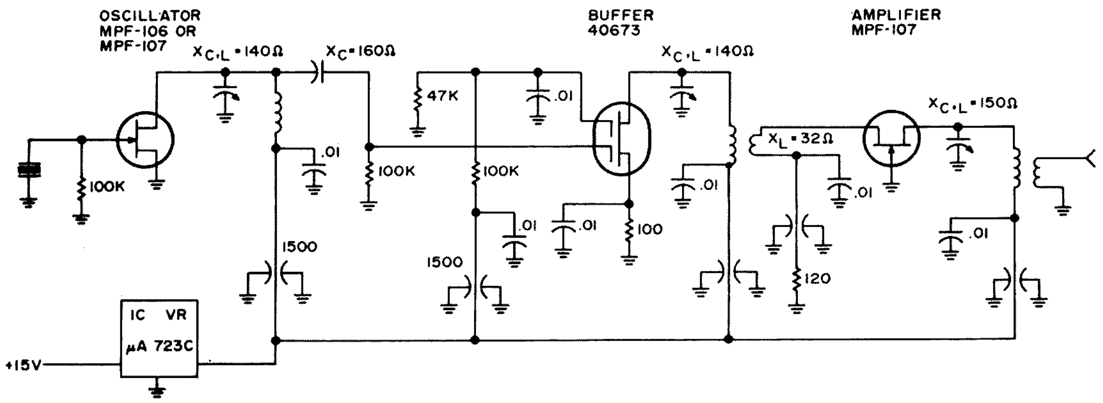
A product detector for 9 MHz SSB. The values in parentheses are for 455 kHz.



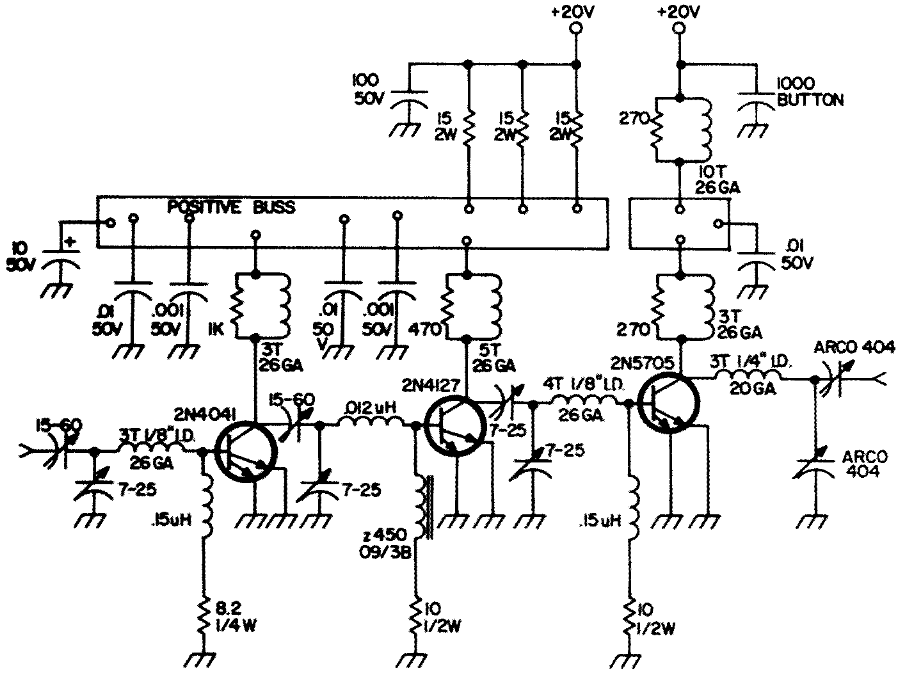
This simple circuit, known to electricians as a three-way switch, for controlling a light from two separate locations, is also a rather exotic digital logic circuit. No gate used in digital logic is any more complex than this circuit, though it may have more control points.



This two meter band edge marker provides useful harmonics up to several hundred MHz with 18 or 24 MHz crystals. Though originally designed for a PNP transistor, a NPN type such as the 2N706 or HEP55 may be substituted if you reverse the supply voltage connections.

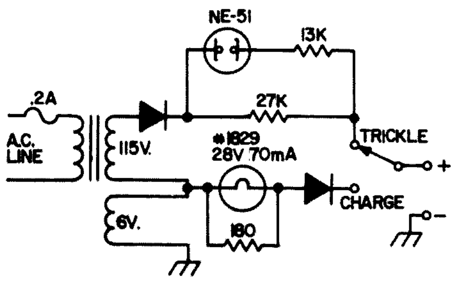


Ultra high stability crystal oscillator circuit that is useful for microwave transmitter frequency control. Use crystals from 1.6 to 160 MHz, fundamental or overtone. For best results get the values of the coils and capacitors for any specific frequency from your friendly neighborhood reactance chart. Thanks to WA2NKL.

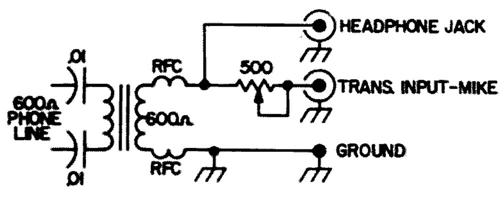


ALL CAPS IN MFD UNLESS OTHERWISE NOTED

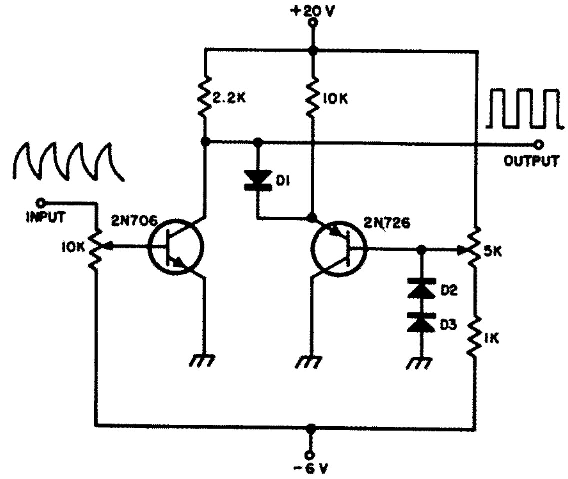
2 meter amplifier that has 20 dB gain. 100 or 200 mW input will be amplified to 10 and 20 watts respectively. Be sure to keep leads short and make all grounds directly to the circuit board. The positive buss is separated so the final can be AM modulated. For FM, just connect the two terminals together. Don't forget to use heat sinks! Thanks to K6TOV.



Nicad charger suitable for the HT220 or other hand held rigs. The dual indicator lights automatically let you know if you are on trickle or full charge. This is a schematic of the Motorola NLN6804A charger. Thanks to WA7CYY.



Simple phone patch for experimentation purposes. Adjust the mike gain on the transmitter as you would normally and set the 500Ω potentiometer for proper modulation by the telephone audio. Thanks to WA7CYY.



ALL DIODES GENERAL PURPOSE SILICON

The square wave output of many inexpensive signal generators deteriorates quite badly at high frequencies, but this circuit will square them off again. The diodes may be any inexpensive computer type such as the 1N914.

(Continued on page 143)

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

HELP WANTED – Assistant Circulation Manager for 73 Magazine, male or female. Must be fluent in English, have proficiency in reading/writing Spanish, and have typing ability. Prefer ham or previous ham, domestic or foreign. Send resume c/o Circulation Manager, 73 Magazine, Peterborough NH 03458.

COMPLETE 36 page QSL catalog, 3rd edition. New "SPARKLING" QSLs. Hundreds of cuts, ten report forms, thirteen colored stocks, 25¢. Ten sample QSL cards. Corneilson's Quality QSLs, 321 Warren St., N. Babylon, N.Y. 11704.

STANDARD 826M 8 channels with battery pack & antenna, excellent condition. $250. Gary Goldberg WA2FAS, 24 Gardenia Drive, Maple Shade NJ 08052.

WARREN HAMFEST, Largest family style Hamfest in East. Sunday, August 19th, @ Famous Yankee Lake Park. Giant Fleamarket, Swimming, Picnicking – All Free. Details QSL W8VTD.

VOICE MULTIPLEX 50 Channels Solid State SSB RFL2710R, 2710WRR 5 years old mint, 50% off new price. 610 South Arroyo Parkway, Pasadena, California 91105. 213-648-2000.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

SELL: E.E. and other technical books. SASE for list. Roger A. Baim, WB9BDP, 2753 W. Coyle, Chicago, Ill. 60645.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Hallicrafters FPM 300 SSB xcvr	$480
Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾m	$255
Digital Logiclocks	$80

FOR SALE TO THE HIGHEST BIDDER – Collins KWM2-A, AC power supply, station control, 30-L1 Linear Amplifier, mobile mike – offered as one unit... Complete Collins S Line: 31S3, 75S3, AC power supply, station control, recently calibrated by Collins. Excellent condition. Send offers to: WA2KNC Jack Aviv, 106 Glenn Avenue, Lakewood, NJ 08701.

SSTV FOCUS/DEFLECTION COIL KIT for K7YZZ 1¼" Plumbicon type camera circuit (re., 73 Magazine, Sept. 72) complete with reprint article, $19.95 postpaid in U.S. and Canada. Also fast scan 1¼" coil kits as well as many other SSTV kits, parts and plans. See regular ad elsewhere in magazine. Write or phone for free catalog. ATV RESEARCH, 1301 N. Broadway, Dept. 73C, Dakota City, Nebr. 68731.

"Don and Bob" guaranteed buys. Triex W-51 386.00; MW50 250.75; MW65 331.50; Ham-M 99.00; TR44 59.95; AR22R 31.95; Belden 8214 RG8 foam coax 17¢/ft; 8448 rotor cable 10¢/ft; HyGain TH6DXX 139.00; 204BA 129.00; TH3MK3 114.00; 400 rotor 179.95; Mosley CL36 149.00; CL33 124.00; TA33 114.00; MCQ3B 91.00; S402 143.00; 3/16" cable clamp 18¢; Mallory 2.5A/1000PIV epoxy diode 29¢; Polygon fiberglas spreader 7.50; KY65 code ID 5.95; write quote Midland, Regency; Clegg FM27B; Hallicrafters FPM300A; Drake, SBE, Standard, Eimac, Collins, CDE Replacement parts. Shipping charges collect; warranty guaranteed. Mastercharge, BAC. Madison Electronics, 1508 McKinney, Houston, Texas 77002. (713) 224-2668.

TECH MANUALS for Govt surplus gear only $6.50 each: R-389/URR, R-390/URR, TS-497B/URR, CV-591A/URR, URM-25D, TT-63A/FGC, TS-382D/U, URM-32. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

FREE KIT CATALOG: Tone encoders, Decoders, Scramblers, Alarms, Sounders, Automatic Telephone Recorder Phone Patch, IC Kits and more. KRYSTAL KITS, 2202 S.E. 14th, Bentonville, Arkansas 72712.

HR-2, twelve channels, fully crystalled, pre-amp, A/C supply, nicad field pack, charger, antenna, $280. 10w/50w Dycomm, $70. Bruce Berg, 13 Lisa La., Cherry Hill, N.J. 08003.

SALE Drake TR-4, RV-4, AC-4 mint condition $500. WA3QNS J. Reed, 1031 W. Lafayette St., Norristown, Pa. 19401, 215-279-1517.

GREAT CIRCLE BEARING CHARTS. Computer generated for your exact QTH. Each chart gives bearings, distances, and return bearings for 660 locations throughout the world, and consists of six handy-sized 8½ x 11 inch pages. Price $1.00 postpaid worldwide. This non-profit project described in detail in Ham Radio Magazine (New Products) March 1973, and Radio Communication (article) November 1972. Send name and address; name of town for which you want the chart (if rural area, or under 10,000 population, include latitude and longitude or carefully describe location); $1.00. To: Great Circle, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

CANADIANS – FREE 120 page Electronics Catalog. ETCO-B, 474 McGill, Montreal.

DELMARVA HAMFEST – August 19, 1973. Harrington Fairgrounds. Registration fee $2 advance, $3 at the gate. For information, write Delmarva Hamfest, Inc., Route 2, Box 90, Laurel, Del. 19956.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Drake, Regency, Standard, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Mosley, Ham-M, Hustler, electronic pocket calculators, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal, friendly Hoosier service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812)-894-2397.

WANTED: Touch-tone receiver SD94148. Sell: Gonset Aircraft Tuner (108–128 M.C.) w/squelch; Topaz 250 watt mobile power supply. #2E; 1301 W. Estes; Chicago, Ill. 60626.

HT-220 two watt two channel with case – best offer over $75. Box 12, 73 Magazine, Peterborough NH 03458.

Continued on page 122.......

. . . Letters continued from page 109

it – as a corporate entity – giving its members a fair shake . . . are they polled about thoughts, or is it in fact a self-sustaining outfit run for the financial benefit of a few?

A full and open hearing on this subject would be most interesting and could force the League into some thoughtful changes needed.

Nick Johnson tells you how in his stuff directed to TV listeners protesting license renewals of broadcast stations. The same thing would work for the League, you know.

If anybody sees this, or knows what the expiration date of W1AW's license is, let me know and send me copies.

Art Brothers W7NVY
Grouse Creek, Utah 84313

While some major reforms are about 30 years overdue in ARRL management, should these be forced at the risk of losing the W1AW license? The bulletin announcements, self-serving as many of them are, are certainly worth some effort to keep the facility going – and the code practice is invaluable, though it is always possible that if W1AW were not there with it that others would provide the service, as has happened in many other countries.

CB SOLUTION

I have changed my mind about CBers. Why doesn't the FCC just illegalize the use of 11 meters, completely? Then all they have to do is arrest *all* of the band users. The legitimate ones won't operate when this law takes effect, just as they didn't break previous laws. Thus, the big guys who have sunk thousands into their pseudo-ham setups will just be left. Although this may be impractical from some standpoints, I am indicating to you my recent realiz - tion of the seriousness of some of these fellows. The guy down the street just isn't going to stop killing my 10 meter rig. I think we are soon going to change our local transmitter hunts to CB hunts.

Thomas A. Behrens WB6MDP
Sacramento CA

Good idea.

A BAD LETTER

I thoroughly enjoy your magazine and look forward to its arrival. My only regret or complaint is that I did not start my subscription sooner. While you are like all the other magazines in that you print all the good letters about 73, you differ in that you also print the bad letters about it. I always read your "Letters to the Editor" column and I believe it takes some backbone to print some of the derogatory letters. Keep it up. My only other comment is that it a very fine magazine.

Ron Hughes KL7HJE
Alaska

HAPPY ENDING

Last February I wrote to you asking that the theft of my YAESU FT101 be listed in your magazine. In December the equipment was returned to me via the police and my insurance company. To make a long story short, the recovery was attributable directly to the notice in 73 Magazine, *73's policy of continuing the listing indefinitely in subsequent issues of the publication rather than just once,* and the alertness of Gary WB2PSS and Bill of the Pennsauken (NJ) Electronic Service Co., and George WA2VKV.

Many thanks for your help.

Frank W. Widmann WA2YSW
Haddonfield NJ

ECONOMICS PAYS

Congratulations on the really superb article "Repeater Economics" on page 105 of the April issue. Mr. Cohn's story is almost precisely what we have done here in the Mid-Oklahoma Repeator, Inc. for the past nine months. The results have been outstanding. The "MORI" membership has increased from 60 members on 1 July 72 to 131 members on 21 March 73.

The few differences between MORI and NVFMA procedures are minimal. We call the freeloaders "prospective members." We also use my own and the Trustee's address for club correspondence.

About the one real difference is that we use a computer for the membership list. The computer is located at a small junior college. The keypunching and machine runs take only a few moments of time. The benefit is that the MORI officers can ask for a current membership list at any time. It's a matter of dropping in the cards and making the list. We also use the card deck to print the mailing list and it certainly simplifies mailing to 160 or so members and prospective members. We also have a card deck of all other active amateurs in about a 50-mile radius which we have made a mailing to once in the past 9 months.

Newcomers to VHF-FM get into the MORI card deck by just signing their call on the repeater. (Their expiration date is that date until they pay the dues.) From then on, they get everything we send such as bulletins, meeting notices, and the like.

For the various VHF-FM clubs, I suggest that the officers contact the local junior college or the computer company and get the mechanized list thing working for them. Saves a lot of wear and tear when making a mailing and the instant membership list allows the club officers to be active recruiters.

Again, congrats for the fine article.

Frank Jerome W5OJZ
Midwest City OK

. . . . Caveat Emptor continued from p. 107.

DES MOINES HAWKEYE HAMFEST will be held on Sunday, June 17, 1973 at the Iowa State Fairgrounds. Plenty of free parking. Flea Market, covered display booths available, small charge; open arena – no extra charge. Dealer displays, valuable prizes, and XYL activities. Saturday night auto races and camping – extra. Registration \$1.50 advance / \$3.00 at gate. Write Des Moines Radio Amateur Association, Box 88, Des Moines, Ia. 50301.

CURTISS ELAPSED TIME METER \$1.00 each. Famous G.E. P A 222 1 watt audio amplifier \$1.95 each. 100K ½ watt ½% RN70C resistors 4 for \$1.00, 1,000 lot price upon request. Walter Jurek, 1615 S. 59 Ct., Cicero, Ill. 60650.

WANTED, OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

MOTOROLA: P33DEN-1100A PT-300's with nicad low split \$165. U43HHT-3100A MOTRAC with acc. \$175. Robert Anderson, WA3PVD, 10314 Pierce Drive, Silver Spring, Md. 20901. 301-593-6993.

SALE: HW12A \$90. TWO'er, 6 mtr FM REPEATER, HA750, more. SASE for details and list. WA3HRB/3, 3110 Knights Road, B18, Cornwell Heights, Pa 19020.

ILLINOIS REPEATER COUNCIL

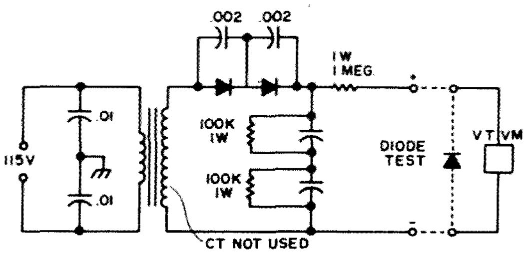
Regular meeting will be held on Sunday, May 20, at 1 p.m. at the Lee County Law Enforcement Bldg., Dixon IL. Talk-in on 146.94.

MODERNIZE FOR PEANUTS! Frame & display QSL's with 20 pocket plastic holders. Two for \$1.00, seven for \$3.00. Prepaid, guaranteed. Universally used and approved. Order now. TEPABCO, Box 198S, Gallatin, Tennessee 37066.

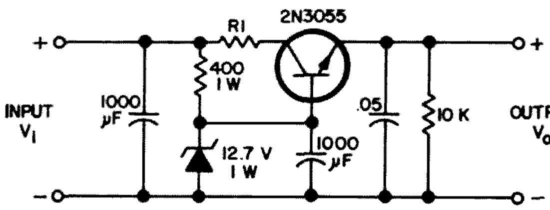
GIANT N.E. CONVENTION sponsored by FEMARA Sept. 29 & 30 at Dunfey's Hyannis Resort on Cape Cod. Huge flea market, seminars, FM, SSTV, NEDXCC, AMSAT, YL trips, 2 pools, golf, beaches, sailing. Early bird registration still only \$3 from W1KCO, 572 Berkley Street, Taunton, MA. 02780. Special early bird hotel discount available.

PRINTED CIRCUIT NEGATIVES MADE. SASE AND QUARTER FOR INFORMATION/PRICES. P-C NEGA SYSTEMS, 186 - 80th STREET, NIAGARA FALLS, NEW YORK 14304.

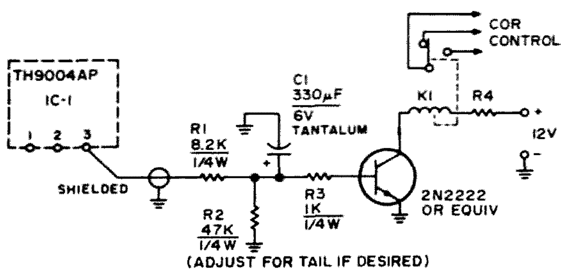
MORE CIRCUITS. . .



A circuit for testing characteristics of "bargain pack" diodes. The transformer is 600–1000V CT and the two diodes in the half wave circuit are 1000 PIV. The filter capacitor should be approximately 40 µF apiece with suitable voltage rating. To test an unknown diode, connect as shown and read the voltage on the VTVM. Two thirds of this reading can be interpreted as a safe PIV rating. Reversing the diode reads forward characteristics – a reading of less than 3V indicates a good diode. No voltage indicates a shorted diode.

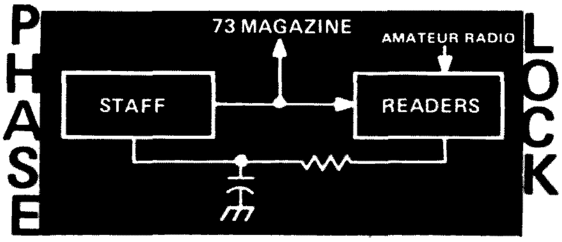


A power supply for a transistorized transceiver. Since rigs tend to draw much more current when transmitting, the transistor in the power supply must dissipate more current. The use of R1 lowers the amount of power dissipated and enables a smaller inexpensive transistor to be used. Choose R1 so the total voltage drop is about 2 volts. R1 = (Vi - Vo - 2V/xmit current). Thanks to WA3EEC/1.



Schematic of a COR circuit for the IC20/21. R4 must be adjusted to keep the collector current of the transistor less than 750 mA. The value is dependent on the relay resistance. The R2/C1 combination controls tail time. The values shown will not respond to quick button pushers also. Thanks to W1WJR.

PHASE LOCK



In this issue, do you think there is a need for more

	Yes	No
Simple construction projects	☐	☐
Complex construction projects	☐	☐
General interest articles	☐	☐
Humor articles	☐	☐
Specialized columns	☐	☐
Operating news	☐	☐

Please use the following space for comments on the articles and newspages in this issue. If you have a specific idea of what you feel would improve 73, please send it to us. If you have *two* ideas, the space below will probably not be sufficient. Instead of attaching a separate sheet (which would be bulky and awkward), you can vastly simplify the process by buying another copy. This second copy should be kept in a safety deposit box as insurance against fires, floods and thefts by nonsubscribers.

Do you receive 73 from subscription ☐
newsstand ☐

Fill out this form immediately and mail it with the Reader Service coupon on the reverse side (or vice versa).

73 magazine

for radio amateurs

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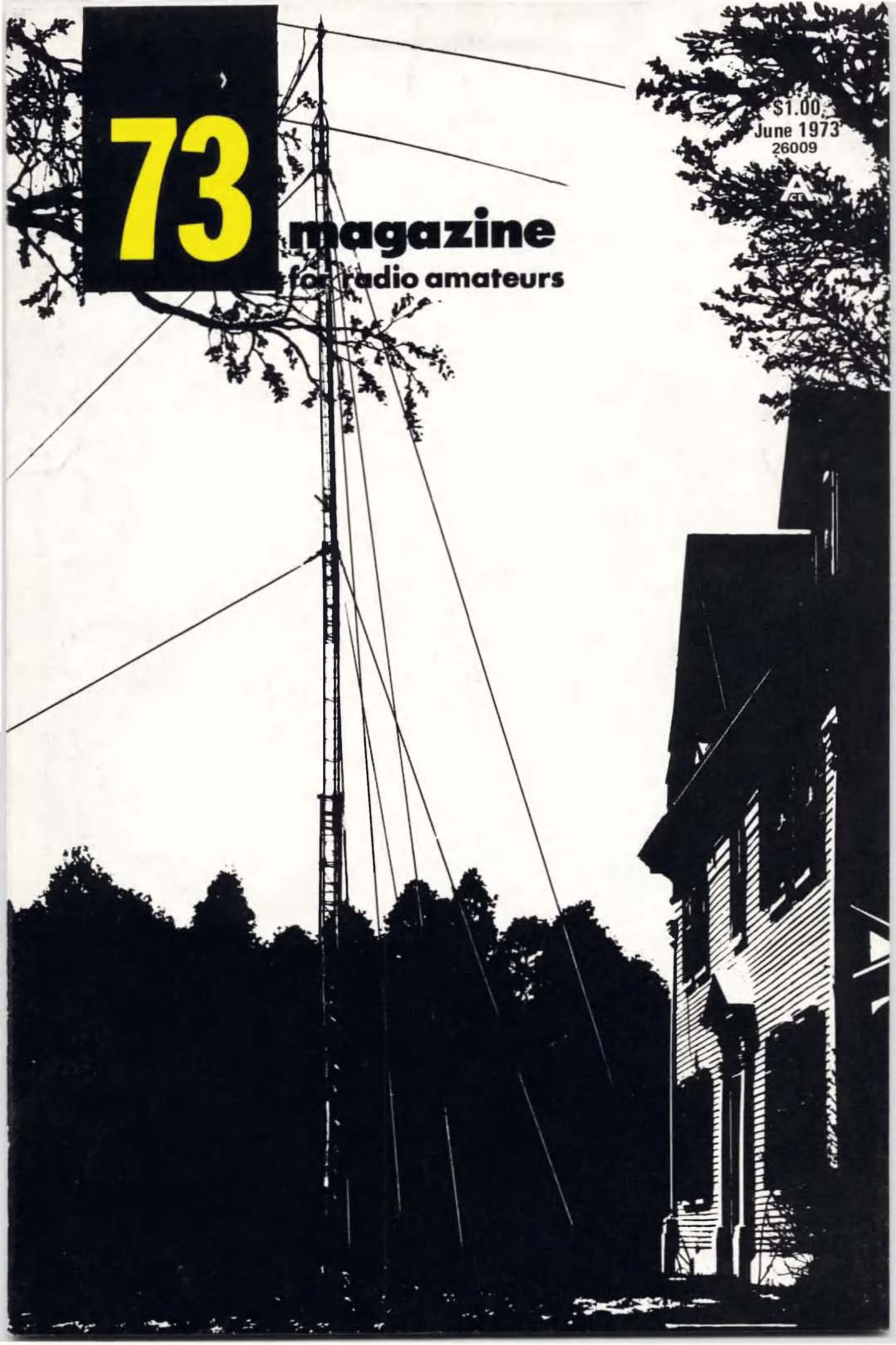

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for radio amateurs
#153 JUNE 1973

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49 **Color Slow Scan Television** **K4TWJ**
A system for direct viewing of color slow scan. What next?

51 **RTTY Autoswitch** **K2YAH**
Great for two meter RTTY.

55 **40 Meter Transmitter** **WB6BIH**
Hybrid rig for inexpensive fun on 40 CW. Good Novice rig.

59 **Polar Mount for Moonbounce** **W4KAE**
Don't all rush to make this up, okay?

63 **The Urban Quad** **K3MNJ**
Tribander you can make – good performer.

65 **Understanding Reflected Power** **W5JJ**
Oddly enough, very few engineers understand it. Read and confound the experts.

70 **The K2OAW Counter Improved** **W9CGI**
Improved accuracy, timebase check, burnout protection, etc.

75 **The Perfect Summer Job** **WA8MLG**
A 73 work-ethic special. Combine hamming with a vacation and get paid for it.

79 **Double Coaxial Angenna** **W2EEY**
Get increased bandwidth with this all coaxial folded dipole.

83 **Non-Falsing Tone Decoder** **W1ELU**
A circuit that keeps illegal transients from tripping your COR.

85 **Calibrated Signal Strength Meter** **VE3CES**
Do you calibrate your antenna to the meter or vice versa?

87 **Portable FM Battery Pack** **K4YKB**
An easy way to fake it if you can't afford a hand unit.

91 **An In-Circuit Ohmmeter** **W6HDM**
Tackle squeamish circuits with this low current device.

95 **Amateur Rules and Regulations, Part I** .... **FCC**
Who will bet that they'll change while we're in midstream?

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A. Entire contents copyright 1973 by 73 Inc., Peterborough NH 03458. Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.

ATLANTA EMERGENCY

WB4CPL

In the late afternoon of March 31st a tornado struck just east of Atlanta, Georgia, and on into South Carolina. Hardest hit was Conyers, Georgia. Within an hour of learning the extent of the damage, the Alford Memorial Radio Club declared their Stone Mountain Repeater W4BOC (16–76) closed to all but emergency traffic.

A walkie-talkie was used in the Conyers City Hall to provide communications from the police, fire and city officials. Many emergency generators were available due to a recent ice storm, but the need was for someone to keep the large fixed units operating. The Rockdale County Hospital lost its power plant 10 minutes after it was started. A ham in north Georgia heard K4YGI's report from the hospital and drove down, as his business is motor-generators. Wire to operate remote functions (water, etc.) at the hospital was found by other hams; as was gas when they ran out about 2:00 a.m.

A new control was rotated among base units near Stone Mountain to keep order in the repeater operations. The Atlanta Radio Club used its autopatch machine, W4DOX, in downtown Atlanta to relieve the load on the Conyers phone system. They also manned their W4DOC base station in the Red Cross building on the 3975 emergency net relaying messages from the Stone Mountain repeater. A pair of 30 kW, 400V, 3 phase generators was obtained via the relay to W4DOX 80 meter station from the Army near Atlanta. It arrived about 14 hours after the tornado struck, to power the city water system.

By the next afternoon most power was restored and the hams pulled out after a very successful operation. That night a thunderstorm blew the Stone Mountain machine off the air for a much deserved rest.

One of the surprising occurrences was the arrival of a group from two local Citizens Band clubs with an emergency van stocked with first aid supplies and an emergency power generator but *without radios.* The non-enforcement of regulations by the FCC has turned their radios into useless junk. It was impossible to use 11 meters on a local basis. They were first-aid trained, however, and many a ham learned that all CB'ers are not brainless dolts.

FLOOD EFFORTS HONORED

Sixteen amateur radio operators were honored for providing emergency communications during tropical storm Agnes between mobile Navy units and Civil Defense Headquarters.

Left to right: Allen Mcquate K3HQC, George Gadbois W3FEY (president of SERCOM), Don House WA3OWD, John Helenthal W3DWS, Lt. Allen B. Caplan, Commanding Officer, Lancaster Naval Reserve Center, K4AVQ; Robert J. Witmer K3VAX and Barry M. Bauman WA3PTE.

The amateurs are members of SERCOM of Lancaster County, Pa., which operates the Lancaster 146.01–61 2 meter FM repeater 24 hours a day. A letter of congratulation was presented to each of the sixteen by Lt. Alan B. Caplan, Commanding Officer of the Lancaster Naval Reserve Center. Alan is also a member of SERCOM and his call is K4AVQ. Those honored were: Roy Smoker K3HLB, Robert J. Witmer K3VAX, Barry M. Bauman WA3PTE, Donald L. House WA3OWD, Robert Landis WA3JMJ, Earl E. Eshleman WA3DMH, John Helenthal W3DWS, Theodore Schriber W3KKX, Clyde Jones WA3HMJ, Ray Enders W3RLT, James P. Murray K3QAW, Allen Mcquate K3HQC, James R. Shank W5CNS, Russel E. Martin W3MFW, George S. Gadbois W3FEY and James W. Burton.

News Pages

10M BEACONS

Three 10 meter beacons have been established in Region 1 to assist in propagation studies and to establish reliable path/conditions information. They are bound to be invaluable aids to amateurs in the rest of the world for spotting band openings now that activity has lessened due to the declining sunspot cycle.

Besides the three stations presently in operation below, others are planned in the near future for Cyprus, Antartica and North America.

DLØIGI, Mt. Predigtstuhl near Salzburg (Austria) 28.195 MHz and 28.200 MHz, between 15–20 and 45–50 min. past each hour.

GB3SX, Crowborough, Sussex (UK), 28.185 MHz.

3B8MS Signal Mount (Mauritius), 28.200 MHz, will QSY to 28.190 MHz shortly.

COLLINS RETURNS

Electronic News, 3/5/73

Collins Radio owns 57 per cent of a manufacturing and marketing subsidiary formed in Japan.

Collins Radio Co. of Japan Ltd., was formed with Kyokuto Boeki Kaisha Ltd. (Far Eastern Mercantile Co.) of Japan.

Initial plans call for production of communication products for maritime and amateur use.

W.C. Hubbard, named vice-president and general manager of Collins Far East international operations, will be based in Tokyo. Mr. Hubbard was vice-president and controller of Collins.

In Tokyo, a Kyokuto spokesman said products of the new Collins subsidiary will be sold on the domestic market and exported to the U.S.

Holding an oversized copy of their new repeater license WR3AAA are FM Association officers Robert McClain W3VRZ, club president, Beaver Falls; Richard Hanna K3VYY, treasurer, Beaver Falls; Chester Calvin WA3LJS, secretary, Patterson Heights; and Kenneth Riggle W3FCQ, chief engineer, Patterson Township. The repeater is located in Freedom PA on 146.25-85.
(Photo by K3KGX)

LAWMEN AIDED

An Associated Press technician, the pilot for a radio station traffic report, two deputy sheriffs, and lots of reinforcements combined forces March 14 to keep three prisoners in custody. Two Milwaukee county sheriffs deputies were transporting three prisoners from Waupun to Milwaukee for trial when the prisoners allegedly tried an escape. Sheriff Michael Wolke says the three – one from Central State Hospital and two from the prison at Waupun, somehow got out of their handcuffs and chains and tried to overpower the two deputies when their car was near Menomonee Falls on U.S. 41. But Associated Press technician Jim Taylor K9ZYS was nearby in his car, and he reported the incident on two meters (146.67) to W9PAS who notified the Washington County authorities, who in turn alerted the Milwaukee County authorities. The pilot pinpointed the location of the trouble for reinforcements. Both deputies were slightly injured, but the three prisoners were quickly rounded up.

DENVER LAWSUIT

Chuck WAØDNH in Denver is in the midst of something even worse than a tower suit. While the usual legal hassles involve large towers equipped with multi-arrays, a lawsuit is being brought against Chuck because he recently erected a Hy-Gain 4 band vertical in his back yard.

Chuck's lawyer is building a defense but is unfamiliar with cases of this sort. He is in need of a vast amount of information so he can effectively protect Chuck and, in the long run, any other amateur in the area who may run into a similar problem.

ANYONE who has had legal action taken against them and survived to transmit again can help. Chuck is desperate. You can contact him by writing: Chuck Kaufman, 3734 So. Poplar St., Denver CO 88237.

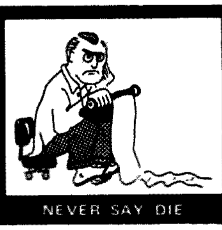
We'd like to keep track of this case and be ready when another appears. Possibly keeping an open file of legal facts that will be kept accessible is the answer. To be effective we'll need facts however, so start digging.

GUATEMALA ON 3RD PARTY LIST

On April 5, 1973, Decree No. 19-73 was passed by the Guatemalian Congress and was signed by President Osorio, making 3rd party traffic legal between Guatemala and the USA.

The notice was published in the *Diario de Centro America,*, the Official Gazette of Guatemala on April 16, and the handling of traffic became legal 30 days after that date.

FUJR BUJR ZKEZK EFULQ EFWQQ RQKW LTC WKEQL US EFYWEQQV EFYWER EPU!



...de W2NSD/1

EDITORIAL BY WAYNE GREEN

GAO REVIEW OF THE FCC

The General Accounting Office has made an extensive investigation of the FCC's ability to enforce their regulations and found them seriously wanting. This finding will come as no surprise to any amateur who has ever listened to the citizens band or to the marine channels.

The GAO is most critical of the FCC for not taking forceful action against willful violators, particularly the citizens banders. They point out that the FCC has made it a practice of reducing or cancelling fines, with the result that enforcement of the rules is virtually impossible. During 1971 there were 502 citizens band operators fined for violations. Of this number ten handed in their licenses and paid no fines, 87 had their fines cancelled entirely, and the remainder had their fines reduced substantially. Only 30% of the fines were collected!

When you consider that there are an estimated 800,000 CBers, of which approximately 799,999 are operating in violation of the regulations – plus who knows how many right in there with them without the benefit of a license – the 502 cited seems insignificant.

The GAO suggests that the FCC might be more efficient if it got out of the business of giving license exams, inspecting shipboard radio installations, and cut way down on inspections of broadcast stations. They suggest turning over license exams to the Civil Service Commission, which is already in that business for other branches of the government. This might be better than having them given by the FCC, though I personally favor an investigation of means by which authorized amateur radio clubs might administer the exams – thereby saving the government the cost of giving the exams. Surely some means can be devised which will result in an honest system.

The GAO makes a point that the lack of enforcement of the citizens band has set up a bad psychological situation which is resulting in a spread of the contempt for regulations which characterizes CB. Certainly we see signs of this in the ham bands. The threat of many repeater groups to react to the new repeater regulations which they consider ridiculous by just ignoring them certainly would never be made if the example of chaos on CB were not there.

Amateurs feel that they have a right to reasonable regulations – and to their being enforced. Right now we have neither.

TVI BILL

The next time you find a piece of paper in hand you could do a lot worse with it than drop a note to your congressman asking him to support HR3516, a bill entered by Representative Teague of California which would make it illegal for manufacturers to put out radios and television sets which would get interference from amateur or CB rigs. How about that! You should know who your congressman is by now.

SALES AGENTS FOR 73

Just recently we've signed on some sales agents for 73 subscriptions and books. This has worked out very well for them – with incomes of $50 to $100 a weekend being reported. One agent made $80 just selling subscriptions at two auctions on one weekend.

This is a golden opportunity to let your hobby start paying for itself and bring you some extra income. There are some good territories left, so if you have the time and means to get to every ham activity within reasonable driving distance and you have a good outgoing personality – you don't sell subscriptions by sitting at a table and waiting for people to find you, you have to make sure that everyone knows you are there and what you are there for – and you have to let them know what you've got and why they should subscribe right away. This means getting some time every now and then on the public address system – going around and keeping after everyone.

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	38.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

LYNCH YOUR SECRETARY

If your club secretary does not send for the special secret club 73 subscription offer and let you know about this incredible trial offer deal, then serious consideration should be given at the next club meeting to forming a lynch mob and getting someone a little more diligent for the job. Passing up this amazing opportunity might be considered by some as an offense to themselves, to the club, to the community, to the country and perhaps to all mankind.

Why take a chance?

Drop a letter to Ace Goodwin W1GRO and demand that he send you the special confidential secret club

(continued on page 104)

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Some confusion over identification and information exchange was noted during the Slow Scan contest this year. Initially the plan was to exchange all information on SSTV; however, Franco did make an exception for those countries requiring SSB identification of SSTV transmissions. In fact, the actual Slow Scan exchange was narrowed down to merely exchanging an ID frame with the QSO number for each contact. You could identify on SSB before, during, or after Slow Scan transmissions if desired (this will probably be the situation next year also). Some problems still arose by stations using only SSB and no Slow Scan. It is my understanding these QSOs were rejected. Remember, this is not a hair, teeth and eyeball DX massacre, but rather a worldwide promotion of the SSTV mode. Yet, like any contact, it must have rules which must be followed. I hope to have the complete contest results next month, either in this column, or the preceding newspages.

We have a guest column this month written by Professor Franco Fanti, I1LCF, on Slow Scan activity in Europe. I have translated his info, thus it may not reflect an Italian accent. Franco was one of the original Slow Scan pioneers in Europe. While SMØBUO made the first European/American QSO, Franco made the first European/New Zealand QSO.

"There is a relatively large amount of home-brew Slow Scan gear in Europe, mostly of the classic MacDonald and K7YZZ design. However, the second and third Slow Scan contest results confirmed the large amount of new commercially built gear now appearing in Europe. Indeed, Slow Scan appears to be catching on heavily in Italy. A large market for SSTV gear is developing on Italy's 27 MHz "business band." In Italy, this band comes under the Postal Department and was first established for their many fishing ships to use, etc. Also (as in the U.S.) many illegal CB-type operators use this band. Now both the legal (businesses) and illegal (hobbyists) are starting to set up Slow Scan gear on this band of frequencies. The utilization of SSTV by large businesses is a trend that may expand into other European countries."

I guess you have heard that JA's can now legally operate SSTV. Judging from the number that had been watching pix on 20 meters, there should be quite a group on very soon. The VK boys say the first ones on had very good pix. No info yet on their gear, but I suspect their manufacturers will be quick to recognize the tremendous market.

Incidentally, I understand some overseas Slow Scanners (and others) are having a real problem securing parts. They send money and orders to stateside companies and that is the last of it. No reply, no parts, etc. I've helped a couple of the fellows by acting as an intermediary – they sent me their money, I bought the parts and sent them to the fellows. If other SSTVers help a DX friend like this, we will soon get even more countries on Slow Scan. Why not ask them about this during your next QSO. Further, I would like to hear what companies the DX ops are having problems with. Then we can pressure them . . . or the involved mail services.

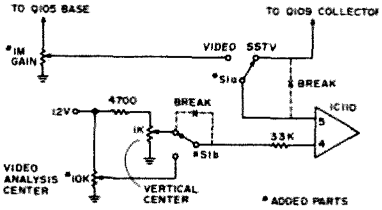


Fig. 1. Modification for the popular 'MXV monitor which enables a stair-step analysis of the received video signal to be displayed on the screen.

Here's another modification for 'MXV type monitors which should prove interesting. Our thanks to Ed Walker VE4CG, for the initial circuit. (You didn't miss the other modification which was in the February issue, did you?) Here the addition of two pots and a DPDT switch converts the screen display to a stair-step spectrum analysis of the received video signal (so called because of the various amplitude displayed for each frequency, or gray shade). The connections originally made to pin 4 and 5 of IC110, the vertical deflection op-amp, are broken and run through each side of a DPDT switch, leaving the "down" position free. The "down" positions now connect to the wipers on the two pots (see Fig.1). The 1 Meg pot adjusts the size of the video discriminator pattern, and the 10K pot is for proper centering of this display on the screen (this may drift slightly, so place it in a convenient location). The monitor now gives either a Slow Scan picture or video anaylsis, depending on the position of SW1. This same principle may be applied to practically any monitor. All that is necessary is to sample the video voltage just before it's applied to the crt (1 Meg pot) and run this small voltage to the vertical amplifier/sweep stage. The second pot (10K pot) is used rather than recentering with existing controls.

K4TWJ

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Good news for OSCAR 6 users – the satellite will now be on for an additional two days per week. The satellite operating schedule is as follows:

Satellite 2/10M translator ON 0000Z Thurs.–2400Z Mon.

Satellite 2/10M translator OFF 0000Z Tues.–2400Z Wed.

It should be noted at this point that it is very important that you do not try to use the satellite during the off times. If you do hear the satellite it will be the command stations either running experiments or recording the telemetry. Telemetry is very important in the operation of the satellite and it is impossible for ground command stations to receive it if the translator is jammed with calls. If you hear someone using the satellite please do not try to contact them. They may be part of an experiment or a test. Instead, log their calls and the time and send it to AMSAT. Also, if the satellite is not allowed to recharge, the batteries will become weak and eventually one will reverse, destroying the satellite for everyone. This problem of weak batteries is caused by the small dimensions of the satellite and limited area of solar cells. To make matters worse, one of the cells is malfunctioning and gives only intermittent power. Please observe these times.

From information received from AMSAT I find that only 42 of the 50 United States have amateurs communicating through OSCAR 6. Stations are badly needed in the following states:

- Kentucky
- Louisiana
- Nebraska
- New Mexico
- South Dakota
- Vermont
- Wyoming

Why not try to gear up these states? Possibly a group could form "DXpeditions" during weekends. Field Day (June 23–24) would be more than an ideal time to try. I have heard some speculation on the possibility that Vermont does not exist! Well, I don't know about that, but if it does I feel that whoever turns that state on had better be ready for one heck of a

time. I know quite a few amateurs whc need Vermont to complete a WAS.

AMSAT has asked us to continue sending signal reports as they really help in determining what OSCAR is doing. In addition, for those amateurs who copy telemetry, anyone observing an extra dot or dash on the end of transmissions from the satellite will you please send this information to AMSAT (time, date, etc., included0? This could indicate some form of degradation in one of the channels of the translator. This could be caused by the abnormally high temperature that has been observed recently and further studies would like to be made on this possibility.

I will continue to publish a list of one reference orbit per day for the month. To find orbital info for other than orbits shown, simply keep adding 115 minutes and 28.75 degrees for each succeeding orbit.

Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W
2860	1	0154.0	75.9
2872	2	0053.9	60.9
2885	3	0148.8	74.6
2897	4	0048.8	59.6
2910	5	0143.7	73.4
2922	6	0043.6	58.3
2935	7	0138.6	72.1
2947	8	0038.5	57.1
2060	9	0133.4	70.8
1972	10	0033.4	55.8
2985	11	0128.3	69.5
2997	12	0028.2	54.5
3010	13	0123.1	68.2
3022	14	0023.1	53.2
3035	15	0118.0	66.9
3047	16	0017.9	51.9
3060	17	0112.9	65.6
3072	18	0012.8	50.6
3085	19	0107.7	64,4
3097	20	0007.7	49.3
3110	21	0102.6	63.1
3122	22	0002.5	48.1
3135	23	0057,4	61.8
3148	24	0152.4	75.5
3160	25	0052.3	60.5
3173	26	0147.2	74.2
3185	27	0047.2	59.2
3108	28	0142.1	73.0
3210	29	0042.0	57.9
3223	30	0137.0	71.7

It is with deep regret that I must announce the death of Clinton A. Petry W3AWN, who died of a heart attack at the age of 67, while on tour in Hong Kong, March 25, 1973. "Cap" has been very active in AMSAT and OSCAR promotion. He was scheduled to be moderator of the SpaceComm forum at the Dayton Hamvention. I am sure his loss will be felt by all.

WB8LBP

FCC NEWS

If you should need to report suspicious or improper radio activity, anomalous signals, or interference, contact the monitoring station nearest you, rather than the FCC in Washington. Address your report or complaint to "Engineer in Charge, Federal Communications Commission, (name of city) Monitoring Station,"at the various addresses given below, listed alphabetically by city or town. The telephone number for each monitoring station is also listed.

P.O. Box 89
Allegan MI 40901
(616-673-2063)

P.O. Box 1126
Denison TX 75020
(Ambrose Monitoring Station)
(214-965-7729)

P.O. Box 6303 Annex
Anchorage AK 99502
(344-1011)

P.O. Box 470
Belfast ME 04915
(207-338-4088)

P.O. Box 374
Canandaigua NY 14424
(315-394-4240)

P.O. Box 251
Chillicothe OH 45601
(614-775-6523)

P.O. Box 6
Douglas AZ 85607
(602-364-2133)

9900 West State Road 84
P.O. Box 22836
Fort Lauderdale FL 33315
(305-583-2511)

P.O. Box 1588
Grand Island NE 68801
(308-382-4296)

P.O. Box 1087
Imperial Beach CA 92032
(714-435-0048)

P.O. Box 632
Kingsville TX 78363
(512-592-2531)

P.O. Box 40
Laurel MD 20810
(301-725-3474)

P.O. Box 311
Livermore CA 94550
(415-447-3614)

3222 McLeod Road
P.O. Box 339
Bellingham WA 98225
(Marietta Monitoring Station)
(206-734-4196)

3600 Hiram-Lithia Spring Road, S.W.
P.O. Box 85
Powder Springs GA 30073
(404-943-5420)

P.O. Box 181
Sabana Seca Puerto Rico 00749
(809-784-3772)

P.O. Box 5126
Santa Ana CA 92704
(714-545-1333)

P.O. Box 191
Spokane WA 99210
(509-244-2141)

P.O. Box 1035
Waipahu HI 96797
(808-677-3954)

FCC ACTION IN RACES DOCKET CASE

In Report No. 8495, dated April 20, 1973, the Commission has ordered an inquiry into the feasibility of expanded operation of the Radio Amateur Civil Emergency Service (RACES), which provides for amateur radio operation during civil emergencies.

A request by the New York State Civil Defense Commission (NYCD), to expand emission privileges for amateur stations in the RACES program was denied.

RACES is a radiocommunication service conducted by licensed amateur radio stations for civil defense purposes only. The amateurs operate on specifically designated segments of the regularly allocated amateur frequency bands, under the direction of authorized local, regional or Federal civil defense officials, according to an approved civil defense communications plan. Amateur licensees and certain grades of commercial radio operator licensees are eligible to operate RACES stations, providing they are enrolled as radio operators in the civil defense organization.

RACES stations share the allocated frequencies with other amateur stations. Since the privileges of amateur radio operators classes (Section 97.7) do not generally apply to the operation of RACES stations, and non-amateurs may operate RACES stations, the Commission stated, safeguards are necessary to insure that non-essential RACES radiocommunication is not conducted at the expense of regular amateur radiocommunications.

The Commission explained that it was ordering the inquiry because it had received no positive response to a rulemaking proposal, adopted March 22, 1967 (Docket 17315), in response to a NYCD petition, and it lacked "any other substantive information" on the need to expand RACES.

Four additional petitions for expansion of RACES were filed later with the FCC.

The Commission invited comments on specific questions as to whether RACES is an effective means of providing needed communications during local, regional or national emergencies; if the present licensing system for RACES stations is appropriate; if RACES stations should be assigned distinctive call signs that could be used only for RACES activities. It also asked for discussion on rule abuses by RACES stations to determine whether they are "commonplace," and what possible solutions exist to end them; if additional frequencies, emissions, or operators should be authorized for RACES stations; the most needed additional privileges; the consequences to both RACES and the Amateur Radio Service generally, if RACES privileges are expended; the consequences if the privileges are not expanded; and additional safeguards, if any, which might be required to insure that non-essential RACES radiocommunication is not conducted to the detriment of non-RACES amateur radiocommunication.

Comments are requested on or before July 1, 1973.

The New York State Civil Defense Commission petition, denied by the FCC, asked for expansion of RACES to permit the use of facsimile, F4 emission, in the 1800–2000 kHz and 3500–4000 kHz amateur frequency bands. The plan called for a RACES radio link to serve as a back-up capability to the primary wireline link in a system for facilitating the collection, interpolation and dissemination of radiological fallout data from monitoring stations throughout the state.

The Commission noted that no one filed comments supporting the New York request. The American Radio Relay League (ARRL) and the New York State Phone Traffic and Emergency Net opposed it. The New York Telephone Company disputed the New York State Civil Defense Commission's contention that New York State's "post-attack wireline survival capability is an unknown," and a radio back-up link was necessary.

The four petitions for expansion of RACES still before the Commission include a request by San Diego County, Calif., to operate RACES stations by radio remote control through a control link using non-amateur frequencies; a request by the California Disaster Office for extensive rule changes, including expansion and revision of frequency allocation for RACES; a request by the Area "D" Civil Defense and Disaster Board, Pomona, Calif., for authorization of 40F2 emission for radioteleprinter operation in the frequency bands 145.17–145.71 MHz, 146.79–147.33 MHz and 220–225 MHz; and a request by a licensee to permit Technician Class licensees to operate in the 503.5–53.75 MHz, 145.17–145.71 MHz and 220–225 MHz frequency bands in RACES, and to authorize the frequencies 146–147 MHz for RACES with emissions of 0.1A1, 1.1F1, 6A2, 6A4 and 40F3.

Action by the Commission April 18, 1973, by Notice of Inquiry and Report and Order. Commissioners Burch (Chairman), Johnson, Reid, Wiley and Hooks.

The Hamburglar
STRIKES AGAIN!

List from Past Issues: Mfr., Model, Ser. No.	Owner	Issue
Coll. 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Collins Mic, Mod.MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No. M-395430	W8HST	11/72
AF68 No. 10888	K5LKL	1/73
PMR8 No. 10918		
M1070 pwr supply		
Trio TR2200 No. 24J969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 828M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA6WOA	4/73
NPC 107m pwr supply		
2, 5AJ-IPL Onan Gen., No. 327886		

The Muskegon Area Amateur Radio Council reports the theft of the following pieces of equipment from their club station sometime during the week of March 12th: Electro-Voice 641 mic on Astatic GN series stand, R.L. Drake R4B receiver SN 11578G, R.L. Drake T4XB transmitter SN 17801G, R.L. Drake W4 wattmeter SN 8390, Swan 250 six meter transceiver SN F154806, and a Swan ac power supply SN 0653556. Any information regarding this equipment may be sent to the MAARC, P.O. Box 691, Muskegon MI 49443 or WA8GVK. Area code 616 – 722-3910 or 744-1400.

Stolen from W6GSR's auto on March 10, 1973 in Berkeley CA: Regency HR-2 Ser. No. 04-C2879 and SB-34 Ser. No. 211828. Please notify Frank Inami W6GSR, 1168 Hillcrest Court, Livermore CA 94550 or the Berkeley Police Department.

Also stolen was a Standard 826, Ser. No. 011268 with an 806 front panel and a Dycomm 500D amplifier from the locked car (it was parked in the driveway!) of Martin Siegel WA2FSD, 22 Burbury Lane, Greatneck NY 11023.

A Motorola HT220, Ser. No. GJ7327 was bethefted from the SUNYA Campus, Albany, N.Y. Replies should be made to the State University of N.Y. at Albany, Washington Ave., Albany NY, c/o Mr. Williams, SUNYA P.D.

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50 MHz BAND

Bill Turner WA0ABI
Five Chestnut Court
St. Peters MO 63376

WA9FEF writes from Chicagoland that March was rather quiet until the 19th when he worked WA1EXN on E. Later the same day a very good aurora set in, providing contacts with WA2DPJ, WA1RFA, W3BWU, WB8NGD and others. The aurora lasted six to seven hours. The following day the band again prodcued aurora, this time for only a short time, but long enough to work Jim WB4YAB of NE Kentucky. Also mentioned was an E opening the 22nd during which WA2DPJ was again heard. Dave mentions too that K0AGJ (also Dave) puts a strong CW signal into the Chicago area and is interested in starting a CW net on 6 meters. Anyone interested may contact him at 3322 W. 17th St., Davenport, Iowa. I might add that Dave is often heard in the St. Louis area calling CQ on CW but seldom is there evidence of anyone answering.

Elmer K0OCN writes that he has returned to 6 meters after several years of inactivity only to find an almost complete lack of contacts on AM. The conversion to SSB is nearly as complete as it is on the lower frequencies. For some years now, and with very few exceptions, all new equipment has been basically SSB with provision in some cases to insert carrier for pseudo AM operation. While there is still some AM operation around, the amount is rather small compared to what it was even five years ago. I have been calling CQ on AM for over two weeks trying to get a signal report . . . not one signal has been heard.

WA7FLB, "Doc," of Mayer, Arizona, has recently experienced a little trouble with his five-year-old linear,

but the problem turned out to be just a bad power switch contact . . . the linear is back on the air and working as well as ever. Doc says he has heard lots of "burbles" of late but not well enough to identify them.

Bob WA5RBI, says Enid, Oklahoma had openings February 3-4-5-8-9-10-12- and 22 covering Maryland to California and Louisiana to Utah. Of the April Ist aurora, Bob says, "I called CQ's both sideband and CW but the only one I got a rise out of was a South Dakota station . . . sure wish I knew who he was . . . I don't think the many signals I heard even realized that the band was open . . . I heard many Ø's yakking back and forth but not doing any listening . . . ." Bob also mentions having worked Arizona (WA7BXK) three nights in a row with 5/9 signals.

Mike WA2DWZ would like to convert a Lafayette HA-460 to FM but can't find a commercial unit with enough deviation at 50 MHz. I have sent along some suggestions, but I am sure Mike would appreciate hearing from someone who has successfully completed such a modification. You may write Mike at 1381 Linden Blvd., Apt. 7F, Brooklyn, N.Y. 11212.

Preliminary reports from the Itchycoo Park VHF ARC "Worldwide VHF Activity" show a 50 to 100% increase in activity over last year. Band conditions in the East provided very good ground wave and a number of stations were able to take advantage of the situation. WA1RFA (Mass.) worked several Pennsylvania stations, including K3YWY and WA3EBX; K1ZKR worked 123 stations in 8 states; WA3NLH worked 9 states with a total of 145 contacts. Congratulations are again due this group for their effort to increase VHF band occupancy.

The April 1st aurora previously mentioned was one of the best I have ever heard. I can recall only one previous opening which could be compared to this one. The first indication here was around 2000Z, the initial period lasted somewhat over 3½ hours, followed by an hour or so lull, then opened again until after the plug was pulled at 0400Z. Signals from unusually far south were heard, with Atlanta marking the southern edge as received here.

April 8th brought a strong but localized opening to Charleston, S.C. I worked the entire 6 meter SSB population of the area consisting of WA3BSZ/4, W4USW, WB4JTY and WB4MJY. No other stations were heard from this end. Several of the above worked WØCCD, Omaha. This was apparently the only other station active on the western end of this particular opening.

WAØABI

HAM HELP

If you need help getting your license, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can.

Gary L. Weseman	**Mike Noar**	**Donald A. Cook**	**Richard Groot**
4170 52nd St, Apt #12	**9940 Belfair St.**	**R.R. 1**	**Rt #1**
San Diego CA 92105	**Bellflower CA 90706**	**Centerville IN 47330**	**Washington WV 26187**

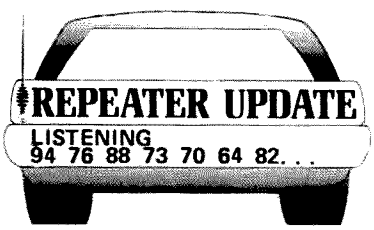
73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS



AZ	W7DAY	Phoenix	52.576–52.525
CA	WR6AAA ex-WA6ZZE	Catalina Island	147.69–147.09
CT	W1EOR	Glastonbury	147.69–147.09
GA		Athens	13–73
IN	WR9AAC ex-W9JBD	Ft. Wayne	34–94
IN	WA9EAU		16–76
MA	K1UZR	Bellingham	146.46–147.06
MA	WA1HDS	Agawam	146.40–147.00
MA	WA1UIZ	Boston	01–61
MI	W8CSQ	Jackson	28–88
MI	W8IIE	Grand Rapids T225B or PL100	16–76
NH	K1VWJ	Londonderry	147.66–147.06
OH	W8NON	Cincinnati	115–70
OH	K8SCH	Cincinnati	07–67
OK	K5CFM Delete K5CEM	Oklahoma City	22–82
PA	WR3AAA	Freedom	25–85
RI	WA1OMS	Providence	28–88
SD	WAØVWH	Rapid City	34–94
TN	K4LSP	Kingsport	18–76
TX	W5AW	Big Spring	22–82

REPEATER DXing

Several repeater groups have asked that some sort of confidential record of telephone call up numbers be kept. Every now and then someone is able to get hold of a Wats line – or has a friend on a test board – or something which makes long distance lines available for a reasonable or less cost – and the thought comes to mind – how about connecting our repeater to another one somewhere?

One local group has been working toward making such contacts in all states. The limiting factor is getting the telephone numbers of different repeaters so they can call in over the autopatch systems.

If your repeater has a call up feature and your group would be interested in getting calls from other repeater groups please send the call up number to *73 Magazine*. We'll keep it reasonably confidential – that is we won't publish it in *73* – and who knows, you might have some extra fun.

UPDATES NEEDED

If you know of a new repeater or of an established machine that has received its WR call, mail in the above form completed with as much information as possible. We would prefer having duplicate – triplicate – even megaplicate information rather than none at all.

TOUCHTONE FOLLIES

HERE COMES THE BRIDE

1 3 3 3
Here comes the bride
1 9 6 6
All dressed in white

TWINKLE, TWINKLE, LITTLE STAR

1 1 9 9
Twin-kle, Twin-kle,
0 0 9
Lit-tle Star

OLD MACDONALD HAD A FARM

6 6 6 7 8 8 7
Old Mac-Donald had a farm
9 9 0 0 4
EE-II-EE-II-OHH!
4 6 6 6 7 8
And on this farm he had
8 7
some chicks
9 9 0 0 4
EE-I-EE-I-OHH!
4 4 4 4 4
With a chick chick here
4 4 4 4 4
And a chick chick there
4 4 4 4 4 4
Here a chick there a chick
4 4 4 4 4 4
Ev-ry-where a chick chick

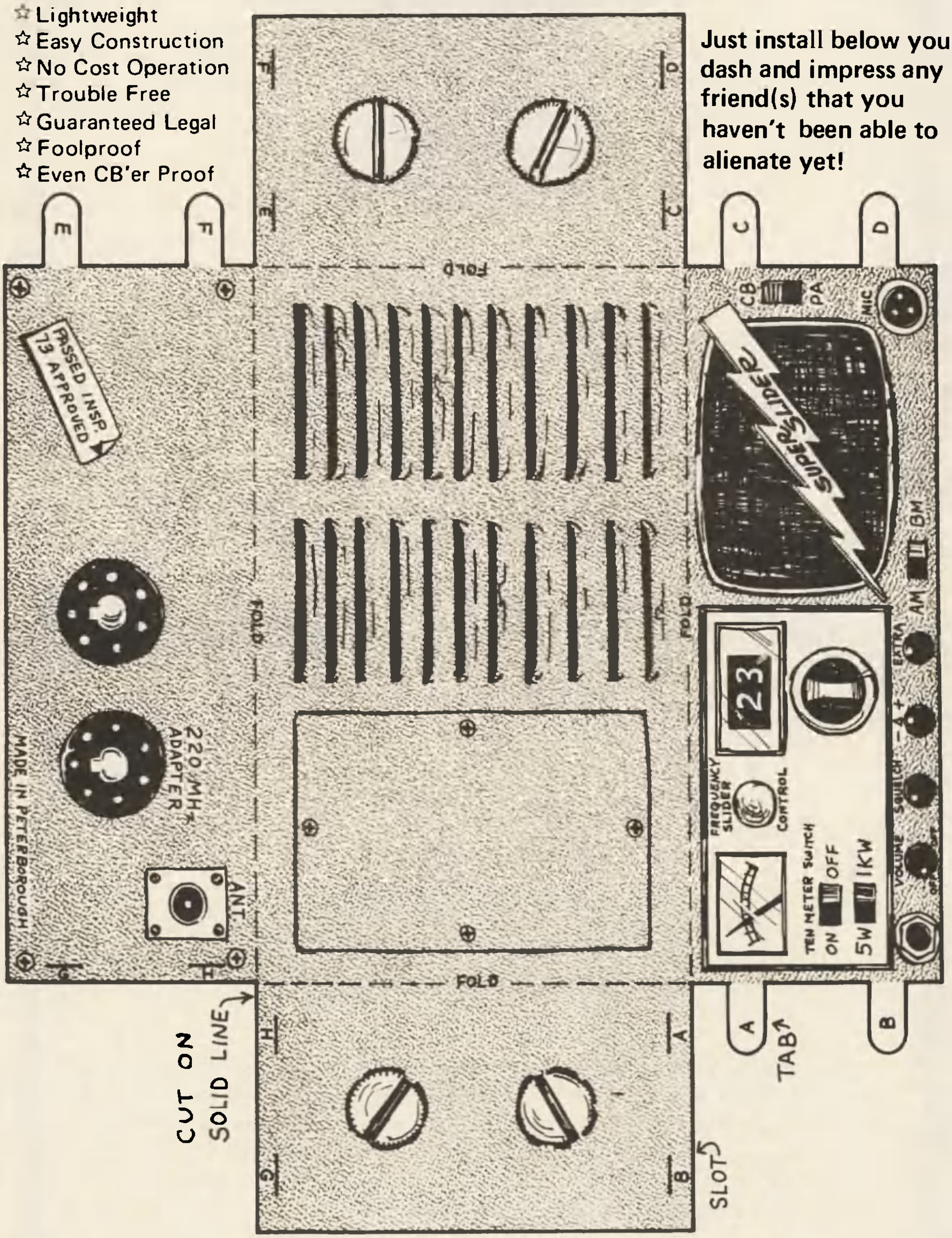
FREE 73 Approved CB Rig Kit!

THE FANTASTIC SUPER SLIDER

FOR CITIZEN BAND OPERATORS ONLY!

- ☆ Lightweight
- ☆ Easy Construction
- ☆ No Cost Operation
- ☆ Trouble Free
- ☆ Guaranteed Legal
- ☆ Foolproof
- ☆ Even CB'er Proof

Just install below your dash and impress any friend(s) that you haven't been able to alienate yet!



NOTE: Although at first glance this construction project may seem to be simple enough for even the most inept CB'er, it is recommended that only CB'ers that have achieved a rating of "Yogi Bear," or above, attempt to build a rig of this complexity.

DX FOOTNOTES

BY, Gus Browning, W4BPD

Setting here each month, thinking of various items to write about DX and looking over a heck of a lot of notes etc. you come to the conclusion that it is impossible to tell you all about everything, this means I am sure to leave out something that quite a few of you would have liked to know or read about, but I have just a certain amount of space for these "footnotes". I try to do what I can in the space available.

It would be interesting to do a real "tracking-down" job on just how certain "rumors" or at times just plain "lies" get started, its easy to see how they get circulated after the first blabber-mouth gets the story. What I would like to track down to the originator, is the rumor that Jack—W2CTN was dead ! I got the info myself from a short letter from K4AEB, Tava who lives over in Huntsville, Alabama. Then I went ahead and published it in my little magazine. When the magazine was delivered a few days later the telephone began to ring, each caller telling me that this was not true. W2GHK, Stu Meyer even phoned Jacks home and was told that this was not true. Of course I retracted the story, mentioning that I got the info from K4EAB. Tava then phoned me telling me that he got the info in the form of a "bulletin" thats published and delivered from the West Coast — Now it would be interesting to find out WHO TOLD THEM ! Just what was accomplished by anyone circulating such a rumor is beyond me to grasp. I know there are "sick people" in the world and it sure would be fine if they stayed out of ham radio, wouldn't it ?

I have found out from a number of letters that NO ONE likes to be referred to as a "garden variety" DX'er ! I mentioned something in a previous article about a "garden variety" DX'er. I suppose my choice of words was wrong or something. I suppose they should be referred to as, "casual DX'ers" or something like that. I wonder what "word " is best to describe a "non-serious" DX'er ?

I see that now the VE6 group of fellows who have plans to put on a lot of the "most needed" countries of the world have delayed their trip somewhat because they are now building a boat of their own to use for some of their island hopping, I suppose. I can tell you this is definitely the cheapest way to "go", but I warn them, look out for that one (or maybe more) land-lubber that may be in the crew, they can cause you a lot of trouble when those seas get a little rough and they begin to get "pink around the gills" ! And, another item of importance is those fellows sure had better be "compatable" since its rough going when 5 or 6 fellows are together 24 hours each day, crammed up in a small boat. I know all about this because I have been in the same situation a number of times and each time I will say to myself, "never again" ! So I am just warning you fellows, be very careful of the "crew" you take along ! If you are a little suspicious now, it will get worse as the trip progresses.

Remember fellows, its wintertime on the other side of the equator, the summertime QRM is nil down there. Since some fellows don't like to do battle from "down under" this may be the only time of the year that you can work certain of them. Of course it may be a little hard on your ears ! (especially if you are on 80 or 160 meters), but it will be worth it if you can snag a good one from down there.

All you fellows who have sent in your WTW applications please be a little patient with me because the printer (NOT ME) was slow in delivering the stickers to me. We issue the basic certificate for the first 100 countries and then when you qualify for more countries later on and send us the info we will issue you a sticker to put on your WTW certificate. When we first started the WTW we had a different certificate printed for each band and mode, this involved a lot of printing and printers bills, so to sort of streamline and cut costs we now use the same basic certificate. We have had a delay in delivery of the 73-73-73 certificates also and I hope by the time you are reading this you will have yours in your hand. In case you haven't heard about the 73-73-73 Certificate let me explain. If you have worked 73 countries in the first 73 days of 1973, you have qualified for the certificate and all you have to do is either send us your cards or just get three licensed ham friends to certify the copy of the list of the stations you contacted in the first 73 days of 1973 and we will send you your certificate. This is 73's year, and NO OTHER MAGAZINE can say that ! And, this certificate is being issued for this momentous occasion and this will never happen again until the year of 2073 and YOU wont be around then to help 73 magazine celebrate.

Plenty of places around the Mid East that are gradually becoming rare DX again. Such an ex-common place as VS9A-Aden is one of them and then there is Kamaran Island that was always more or less rare, now very rare. There is a group of islands right near Aden, but in the Red Sea called the Hanish group, the larger one of them Great Hanish is claimed by Yemen leaving about 10 smaller islands, un-officially unclaimed. Here is a good possible "new country" for some "daring," adventuresome DX'er to go to and operate from. I feel that I should warn you though that you may have to dodge bullets from two directions - The Yemenis and I have heard that Israel just might have someone on some or one of them and they may not like, uninvited visitors coming there, looking around, and maybe "talking" after they depart. If they are anything like Kamaran Island they can have the place as far as I am concerned (Kamaran Island is near-by so I would assume they are all alike more or less.) Very hot, humid, sandy with very little breeze, and when that blows its very hot - sort of like a blow torch. From a DX viewpoint, its very FB, from ANY OTHER viewpoint its "unhealthy". I wonder when that part of the world will really open-up again - if ever ?

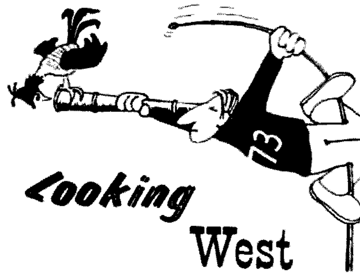
Looks like good old ten is gone for some years, and if things go like they did some years back fifteen will be the next one to be almost gone except a very short time each day and some days it never did open up for any worthwhile DX to speak of. Better get your "needed" countries on fifteen right now fellows, because you might not have that DX in there too much longer. Get 'em NOW !

I wonder what ever happened to the plans of Martin, OH2BH going to that "new one" somewhere up around the Baltic Sea area ? It was supposed to be a Brand New One, or so I understood. How about it Martin Ole Buddy ?. Lets get "hopping" and put it on the DX map, and just exactly where is it anyhow ?

Then there is a little small piece of land (actually mountain) at the Kyber Pass thats a Neutral Zone, looked like a good possibility for a new one when I went through Kyber Pass some years ago IF you could TRUST those guards with those Long Barreled guns who act as border guards there - They looked MAD and MEAN to me ! I didn't even SLOW DOWN after being checked by their Passport control.

We are still looking for a good Ham Club in some USA call areas to be our WTW check points, no "pay" but we will publish the name of the various clubs a few times each year thus they will get a little "free" publicity, which is not bad for them.

de, Gus BPD



Looking West

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

By the time you read this, the first WR6 repeater will be in operation. The prize WR6AAA call has been issued to the Catalina Island Repeater which will be going on the air shortly. This will also to my knowledge be the first amateur repeater to operate from an island, and coverage up and down the Pacific coastline should be very good. I know everyone congratulates Catalina on their two firsts.

As I mentioned last month, my pet project has been to try and set up a transcontinental repeater link between one of the local L.A. repeaters and a machine on the east coast via telephone. I already have this end set, but need some help from the other side. If your group is interested, please get in touch with me. This will not be a cheap project (unless your club or repeater has access to a wats line; we don't). Aside from the fun aspect of the project, it will enable FMers here and back east to exchange ideas on a one-to-one basis.

For a long time we have wondered when repeaters would settle the question of what type of break meant what. Get on one machine and say, "Break;" you are welcome. Get on another, do the same, and 25 fellow hams jump to tell you that you are committing a cardinal sin. About a week ago I received in the mail what I think may be one good way to go and present it here for your consideration. It comes from George K1TKJ, who owns and operates WR2AAA (ex WA2SUR) and WA1KGK.

"Use the word BREAK if your traffic is URGENT (NOT emergency). Use Break-Break Emergency only when life is at stake. Traffic reports are not emergencies and should not be broadcast to the world at large. Call a station on frequency and tell him – everyone else will hear at the same time."

Basically, what George says, is to use your call (i.e., WA2HVK/6 or WA2HVK/6 on frequency) to enter a QSO already in process, and reserve the Break, and Break-Break Emergency for times only when they are necessary. Having operated WA2SUR almost from the time it went on the air, I know the validity of this system first hand, and it works. It's a good step in the right direction, and well worth consideration as a national standard.

All repeaters have jammers. They come in all styles from the ones who like to wipe out a QSO in progress with an unidentified carrier, to the music players, to the type who have to prove their lack of manhood by uttering obscene language atop another QSO. To put it bluntly, there are sick people found in every facet of life, and we here in ham radio are unfortunate enough to have our share. It is beyond my comprehension why someone would spend the time and money necessary to join this "un-elite club" that gets its kicks by making life miserable for everyone else on the channel, when the real enjoyment is in belonging.

The best method I know of to date in handling one of these problems is to simply ignore it. It's not easy, especially if the *jammer* is aiming his attacks at you personally. Give a jammer an audience and you will have him with you for a long, long time. Ignore him, and he will eventually crawl back into the woodwork. To again quote the WR2AAA group,

"To acknowledge a nut is to encourage a nut."

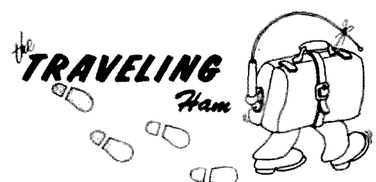
If he insists on staying around long enough, he will eventually get caught, his toys taken away and he may even get sent to bed without his supper.

Heathkit has come through as we all hoped they would. By the time the March issue hit the stands, their VHF Scanner was already on the market, and now they have announced their HW202 Two Meter Transceiver, designed for those of us who like to roll our own. It's sure a neat little package with that built-in tone burst encoder. Now who will be first with a 220 MHz transceiver kit?

That of course gets us to the subject of 220 and some good news. The WB6ALV and W6FNO two meter groups are in the process of assembling 220 machines, and two others are in the works. One belongs to the four guys who record meetings for me when I can't make it. The other, tentatively dubbed "The Icom Amateur Radio Club" is the brainchild of Bill WA6NTW, Max K6GLG and Warren WA6JMM. It will be completely solid state and located on a hill 1300 feet above the L.A. basin. It seems that a number of years ago Bill had a 220 AM repeater on the air out here (probably the first anywhere) but took it off the air due to lack of users. We hope his present effort meets with greater success.

Going down by about 150 MHz or so, a quick note on 6 meters. While activity there is in no way overwhelming, there are quite a few stations that seem to be dedicated to keeping the band alive. Such a group worth noting is the Los Angeles Metropolitan Traffic Net. They meet every evening except Sunday at 50.40 MHz AM. I happened across the net one evening last week, checked in, and originated some traffic to Lou K2VMR in New York. Lou received the message in less than 24 hours and confirmed receipt! Now that's what I consider traffic handling.

WA2HVK/6



The Traveling Ham

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

At this time of the year most of us are about to take a well-deserved vacation. Those of you coming to Washington D.C. might be interested in reading about amateur radio in the Washington area.

Two meter FM is very active. There are repeaters on 01–61, 07–67, 28–88, 31–91, and 37–97 (whistle-on) in the area. Both the 01–61 and 31–91 repeaters have autopatch facilities. There is no repeater on 34–94, but 94 is a well-used simplex channel. By the time this article gets into print there should also be repeaters on 22–82 and 25–85. The 25–85 repeater is being assembled by AMSAT, so if you wish to talk to the active AMSAT personnel, carry 25–85. 85 simplex is being used at present as an AMSAT intercom channel, and the 25–85 repeater is planned to improve the coverage. If you are driving into Washington, there are also repeaters located near Washington. 04–64 is in Damascus, Maryland (north of Washington on I-70s), 16–76 is in Baltimore, 13–73 is in Frederick, Maryland and 146.46–147.06 is in Annapolis. Although these repeaters are some distance from Washington, anyone with a handy-talkie in a tall hotel will have no trouble in communicating through them.

Talking of handy-talkies, do you own a TR-22? Well, this month's column was written with you in mind.

TR-22 Modifications

Have you ever waited for a call (on the TR-22) in vain, only to find that the rig was switched off, or have you ever put the rig away for the night and

come back the next morning to find that your batteries are discharged because you left the rig on overnight? For about $1 and a little effort you can insure that such things will never happen again. The magic cure is known as an LED (a light emitting diode). This is a solid state lamp that will put out a good visible light for about 10 mA of current. It is even detectable in bright sunlight.

The modification is simple: just connect the LED in series with a 1 KΩ resistor and put it across the 12V supply line. There is plenty of space to put the resistor inside the rig. The LED can be a Fairchild FLV-110 or other manufacturer's equivalent. I used a HP device because it came with a handy mounting bushing. The LED (and/or bushing) is pushed into the hole already drilled in the panel and a dab of epoxy cement put on it to hold it in place.

This modification gives the rig a power-on indicator, improves the appearance of the TR-22 and should be equally applicable to other FM rigs.

Have you ever wondered what is under that "stuck on" label on the front panel of the TR-22 (in older models), but have been unwilling to find out for fear of defacing the rig? Well, wonder no more — for under the label is the original panel logo that says Trio TR-2200. The panel comes off easily and does not leave any marks on the panel. Tell someone you are running a TR-2200 and they will say, "What kind of a rig is that?"

Have you ever had any difficulty in remembering what crystals are in which switch position? You have? Well, W3ATE has come up with an instant modification that will end that problem forever. The TR-22 switch knob has a see-through section that indicates the selected channel.

The modification works like this: First, determine the crystal positions. Set the knob to position #1, then loosen the two screws in the knob and remove it. You will then see the channel numbers. Prepare some stick-on labels as follows: Type on the sticky labels the numbers to correspond to the crystals — for example, 91 would be 146.91 MHz and 94, 146.94 MHz — then stick these labels over the switch position numbers. You might even make simplex channel labels of a different color than the repeater ones. Then replace the knobs and tighten the screws. Make sure the knob goes into its original position (position #1) when you tighten it up.

The channel number modification is the most painless and should be tackled first. When you have done that you might develop the courage to drill a hole in the panel, but take care.

G3ZCZ/W3

SOCIAL EVENTS and CONTESTS

MASS. AMATEUR RADIO WEEK!

The Amateur Radio Operators of Massachusetts invite all amateur radio operators to participate in the Fifth Annual Massachusetts Amateur Radio Week. Certificates of Recognition will be issued to all amateurs who take part in the Operations program for the week. Operating times are from 0001 GMT June 10th to 2400 GMT on June 16th. Massachusetts amateurs must work 16 other Mass. amateurs. The rest of New England, work 8 Mass. amateurs. All other U.S. amateurs must work 5 Mass. amateurs. DX, including KL and KH, must work 2 Mass. amateurs. Any band and mode may be used.

Applicants must include a No. 10 size stamped, self-addressed envelope (DX enclose 1 IRC) with their application, which must be received no later than July 31, 1973. Submit applications to William C. Holliday WA1EZA, 22 Trudy Terrace, Canton MA 02021.

ORLANDO HAMFEST

The Orlando Hamfest/Southeastern FM Convention will be held in Orlando, Florida June 2nd and 3rd, 1973. Location: Fairgrounds Exposition Hall in downtown Orlando. Further info may be obtained from Clair E. "Buzz" Showalter, W4UFL, 1810 Lorena Lane, Orlando FL 32806.

RTTY PICTURE — Courtesy K2AGI

DES MOINES HAWKEYE HAMFEST

The Des Moines Radio Amateur Association will hold a Hamfest Sunday, June 17, 1973, from 8 a.m. to 6 p.m. in the Teen Town Arena of the Iowa State Fairgrounds. Give Pop a present for Father's Day and bring him to the Hawkeye Hamfest. Lots of free parking — refreshments — lots of room for Flea Market. Limited number of covered booths and extra tables available at small charge. Open area inside the arena at no extra charge. Dealer displays, valuable prizes and XYL activities. Auto races and camping on Saturday night, extra. Registration $1.50 advance, $2.00 at gate. Write Des Moines Radio Amateur Association, Box 88, Des Moines, Iowa 50301.

AKRON GOODYEAR PICNIC

The Goodyear Amateur Radio Club (Akron) will hold its 6th Annual Hamfest Picnic on June 17 at Goodyear Wingfoot Lake Park east of Akron, 1 mile west of Suffield, Ohio on County Rd. 87 near Ohio Rte 43. Join us for an enjoyable day of entertainment, swap-and-shop, prize awards, and good fellowship. Refreshments, displays, huge flea market. Hours: 10 a.m. to 6:00 p.m. Family admission $2 prepaid, $2.50 at gate. For details, tickets, and map, write to Floyd Gilbert, 1976 Newdale Avenue, Akron, Ohio 44320.

CENTRAL KANSAS ARC

The annual hamfest is scheduled for Sunday, June 3, 1973, at the 4-H Complex, Kenwood Park, Salina. For early arrivals there will be a dinner Saturday evening. Registration starts Sunday morning at 9:00 a.m., with a program of interest to OM, YL, XYL, and harmonic. Covered-dish lunch with beverages supplied by the club. Talk-in on 146.34–94, and 3920 kHz. For more information write WNØDEO, William Peck, 1028 W. Ash, Salina, Kansas 67401.

PENN-CENTRAL HAMFEST

The tenth annual Penn-Central hamfest will be held by the Williamsport and Milton clubs on Sunday, June 3, 1973, at the Union Township Volunteer Fire Co. grounds on Route 15 in Winfield PA. This informal hamfest with indoor and outdoor facilities for contests, auction, and flea market, will start at 12 noon. Gate registration $3.00, XYL and children free, free parking. Talk-in on 3940 and 146.52/146.94 MHz. More info from Clair Yeagle WA3QXI, 714 N. Main, Watsontown PA or call 717-53809292.

ARMED FORCES CONVENTION

On-the-air amateur radio facilities will be provided by K4NAA during the Armed Forces Communications and Electronics Association convention in June. K4NAA is the official AFCEA amateur radio station, providing attendees with amateur facilities to contact friends during the convention on June 5, 6 and 7, 1973. The K4NAA portable station will be operational from 1000 to 1800 EDST with two available positions for CW and SSB on the 10, 15, 20, 40 and 80 meter bands. A specially designed QSL card has been prepared. Please bring your original FCC license if you plan to operate. The convention will be held at the Sheraton-Park Hotel in Washington, D.C.

WORKED ALL MASS. CITIES & TOWNS CONTEST

In celebration of Massachusetts' Radio Week, a contest will be held from 0001 GMT June 10th to 0004 June 14th. One point is scored for each station worked, regardless of band or mode utilized. There are a total of 351 Mass. cities and towns and the final score is the no. of different Mass. stations worked times the no. of different cities and towns worked. Entries must be recieved no later than July 31, 1973, and submitted to Nina Robbins, 30 Prospect St., Bridgewater, Mass., 02324. For complete contest rules write to Steven Rich WA1DFL, Publicity Chairman, Massachusetts Chapter National Awards Hunters Club, 31 Arlington Ave., Revere MA 02141.

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The Egyptian Radio Club Inc. will hold its annual Ham-Picnic Sunday June 24, 1973 at the Club grounds, 700 Chouteau Slough Rd., Granite City, Illinois. Something for everyone – prizes, games for the children, food at the club house, parking for swaps – etc. For further info write Andy Anderson K9KXP, 1712 No. Keebler St., Collinsville, Illinois 62234.

ROMAN HOLIDAY

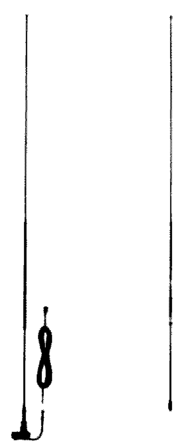
The Rome Radio Club sponsors its 21st consecutive Ham Family Day on Sunday, June 3, 1973, at Beck's Grove, 10 miles west of Rome. Technical talks, contests, equipment displays, ladies' and children's fun programs. Meetings: The Post Office Traffic Net, Air Force MARS, and Repeater Council. Flea market with plenty of display space. Registration starts at 11:00 a.m. and ends with that famous (all you can eat) steak and chicken dinner served at 5:00 p.m. Advance reservations: Adults $5.75, children under 12, $2.00 – under 6, FREE. Tickets at the gate: add 50¢. Tickets w/o dinner at gate: Adults $2.00, children, FREE. Send your reservation ASAP to Rome RC, P.O. Box 721, Rome, N.Y. 13440.

ATLANTA 45th ANNUAL HAMFEST

This event will be held June 9 and 10, 1973, at Lenox Square, Atlanta, Georgia. Approximately 2,500 amateurs attended last year's hamfest, and with the expected continued growth it is sure to become one of the biggest in the U.S. For information write Philip R. Cass W4BTW, VP Atlanta Radio Club and Hamfest Committee Chairman, 175 West Wieuca Road, N.E., Atlanta GA 30342.

NEW PRODUCTS

2m MOBILE COLLINEARS



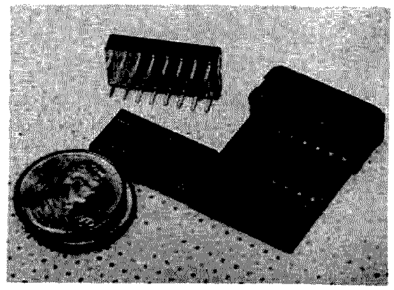
Extremely low radiation angle, 5.2 dB gain over a 1/4 wave ground plane, low SWR and wide bandwidth are features of Hustler CG-Series Super Gain two meter collinear mobile antennas from New-Tronics Corporation.

Model CGT-144 is a complete system including collinear antenna with stainless steel radiating sections, 180° swivel ball, heavy duty trunk lip, and 17' Mil Spec RG-58-U coax with factory attached connectors. Power rated at 200W FM, the completely operational CGT-144 has a SWR of 1.1:1 (typical) at resonance and a SWR within 1.5:1 over its 6 MHz bandwidth of 143–149 MHz. Overall length is 86 inches.

The Hustler Model CG-144 consists of the 84" collinear antenna with 3/8'-24 threaded base to fit standard mobile ball mounts. It has the same outstanding electrical characteristics as the Model CGT-144.

For complete specifications contact *New-Tronics Corporation, 15800 Commerce Park Drive, Brook Park OH 44142.*

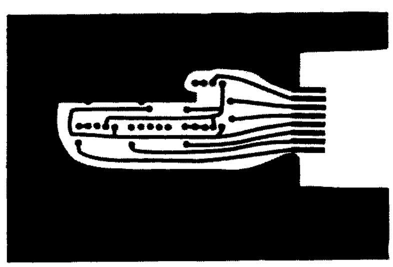
DIP SOCKETS



A new line of 14- and 16-pin dual-in-line sockets incorporates a tapered entry way for easy automatic or manual insertion. The wide, chamfered entry accommodates slightly bent or misaligned component pins and guides them to strong gold plated beryllium-copper contacts. The compact R714-2 and 716-2 sockets reduce the height of DIP components by nearly 50 percent over conventional sockets. The individual contacts are precision spaced for insertion in perforated circuit boards and they may be placed immediately end-to-end or side-by-side for maximum packaging density.

The sockets are available in 1000 unit packages and also in five unit packages for smaller users. Contact *Vector Electronic Company, 12460 Gladstone Avenue, Sylmar CA 91342.*

POSITIVE PC PROCESS

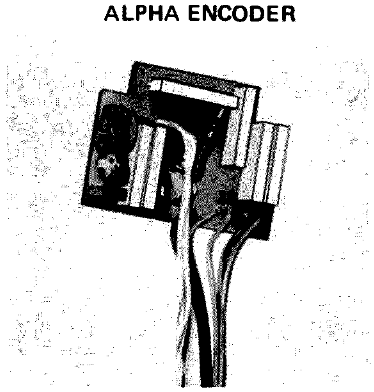


Vector has introduced a pc board that is factory coated with + positive photo resist that does away with the usual artwork reversing step required with negative resist. After using their pre-printed pads, contact tabs and tape interconnections to lay out the full size pc pattern on a piece of clear mylar film, the completed master is placed on the photo sensitized board and a contact print is made under photo-floods or in strong sunlight. The board is then dipped in developer

for about three minutes and the board pattern will appear, ready for inspection and possible retouching. At this point the board is complete except for etching, drilling and trimming, which are normal operations anyway.

The big advantage with the Vector method is that no special equipment, other than a nimble set of fingers, are required to produce (and reproduce) high quality pc boards. Everything you need is supplied with one of their kits, the + positive photo sensitized board, layout tape and film, developer, the etchant and even a plastic bag for use as an etching container. One happy volunteer working in the XYL's kitchen can turn out enough boards in an evening to keep his buddies happy for a long time. Contact *Vector Electronic Corp., 12460 Gladstone Ave., Sylmar CA 91342. (212) 365-9661.*

ALPHA ENCODER



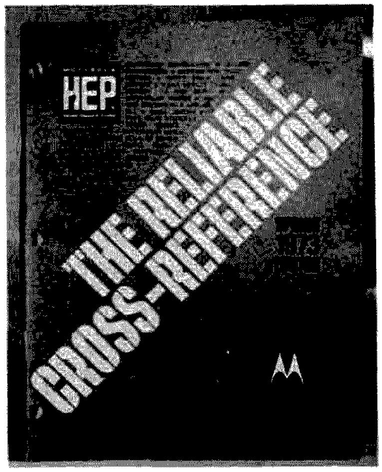
The new Alpha ST-85J-107 multi-frequency encoder makes it possible to encode up to five frequencies of sub-audible continuous tone or high frequency burst tone (20 Hz to 3000 Hz) and is ideal where multiple base station or multiple repeater tone access is required.

For rigs not equipped with the necessary pin sockets, a kit is provided that can be field installed and a five position tone selector switch is included along with complete instructions. The ST-85J-107 is comprised of miniature plug-in thick film hybrid modules, which makes changing frequencies or adding frequencies exceptionally simple. The thick film hybrid technique and the all electronic non-reed design, eliminates many of the problems generally associated with the use of reed relays. There is no falsing from vibration and a far greater degree of shock resistance from dropping.

Frequency stability is plus or minus 5% over a temperature range of -40° to +100°C. Current requirement 3.5 mA at 12.6V dc.

For more information contact *Alpha Electronic Services, Inc., 8431 Monroe Avenue, Stanton CA 90680 (714) 821-4400.*

HEP INDEX



The new 1973 Motorola HEP cross reference guide contains over 43,000 isting of transistors, diodes and SCR's with HEP replacements for each. Besides the 66 pages of listings, there is a complete catalog giving ratings, characteristics and base diagrams for each HEP device. Handy guide lines are given that will assist a beginner to select and get the most performance from HEP substitutions.

The Cross Reference sells for 50¢ at most electronics distributors or from *Motorola Semiconductor Products, Box 2953, Phoenix AZ 85036.*

TOUCH TONE PAD

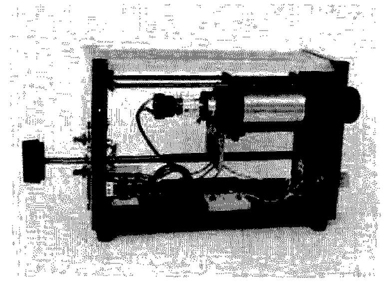
Just about everyone agrees that the ultimate in FM operation is a hand unit that can be carried everywhere. If you work through a repeater with autopatch or Touch Tone controlled functions you could be missing out on half of the available enjoyment if you can't use them. An accessory Touch Tone pad is the answer.

73 recently had a pad installed on a KP 202 hand unit (similar to the Tempo/fmh) by Waller Electronics in Chevy Chase MD. The job they did was superb. Almost looking like original equipment, the pad fits neatly under the speaker and projects from the front panel about the same distance. Practically no weight is added as the tone generator is a miniature IC (negative weight!) and the small mounting case is of a strong alloy.

The unit works great. A squeeze of the transmit bar puts 16 tones at your fingertips so you can place calls through the autopatch from the weirdest locations imaginable.

Contact *Waller Electronics, P.O. Box 9913, Chevy Chase MD 20015, 301-652-0996.*

MICRO SSTV PICTURES



An adjustable carriage kit is available that enables owners of Robot cameras to focus on objects smaller than a postage stamp! A variation of the lens extension principle, the modification lets you move the vidicon back from its original position at the rear of the lens to the proper distance required for close-up focusing.

The kit is uncomplicated and installs in a couple of hours. The carriage mounts between the lens mount bolts and the two existing chassis holes at the rear of the case. The long adjusting screw requires that only one hole be drilled for its rear mount because its front bearing plate is again secured by the lens mount bolts. Focusing is achieved by turning the adjusting screw which moves the vidicon toward or away from the lens. Normal operation of the camera is not impaired as the vidicion can be returned to its original position against the camera's hex spacers.

After the kit was installed in *73*'s Robot camera, everything was hurriedly connected up. The camera was mounted pointing down at the operating desk approximately 7 cm away from the surface. A quick look around for an object on which to focus naturally resulted in a copy of the latest issue of *73*. Positioning a small schematic under the lens and turning the focus screw resulted in a large image of two bias resistors and their

Continued on page 100..........

LETTERS

INSURANCE COVERAGE ADVICE

I am an insurance broker — in New York State you are covered for ham gear if your car is broken into. You can endorse your auto policy and pay a small premium, as I have done on my business accounts where the insurance carrier has charged $10 and added protection of theft of the entire gear. It can be obtained — ask your local broker.

Under Homeowner's policies, we have paid claims for windstorm damage, subject to the Homeowner's deductible of $50 or $100, to antenna, TV or ham. If the amateur has only a Dwelling policy, then have your local broker under the Extended Coverage endorsement, eliminate under Windstorm & Hail the exclusion to Radio or Television antennas, including their lead-in wiring, masts or towers, and coverage will be afforded at the rate of $2.81 per $100 of value. A $1,000 antenna or tower would cost $28.10 per year.

I hope this helps.

Larry Schulman WA2FVP
Flushing NY

$FCC = \frac{W8KID}{2}$

The whole chain of events started slowly back in September 1972 when Carl K8PAX happened to mention that in his business acquaintances he had come across another ham with the call sign W8KID, but couldn't recall any name or address. I assured him that my call sign had not lapsed and I would appreciate his letting me know if he came across the fellow again. I dismissed the whole thing as a mix-up in calls.

My worst fears were suddenly confirmed just before noon December 21, 1972. W8KID/Mobile 8 gave a call on the Muskegon, Michigan Civil Defense Two Meter FM Repeater (K8WNJ 22/82). Monitoring at the time were WA8GVK, WB8HDD, WB8NHX, WA8OJI, W8QAO, W8TBP and WA8SCS, all of whom recognized the call sign but not the voice. Some comments about "bootlegging" and illegal call signs were bantered about, and then my wife, who had been listening to the strange goings on, frantically called me in from my job of shoveling snow. "Somebody else is using your call on the repeater," Jackie said.

I broke in on the frequency only to hear WA8GVK return, "W8KID meet W8KID!" Paul Hollinger, the other W8KID, was probably just as surprised as I at the happening of that day. A fellow ham riding with Paul attested to the fact, over the air, that he did indeed have the call sign W8KID assigned to him by the FCC.

About a month after writing Gettysburg on the subject, Richard C. Zeigler, Chief, Gettysburg Processing Section, sent me a cordial letter verifying the call sign was mine and an explanation of what had occurred.

When Paul moved from Area 9 (formerly K9GAI) to Area 8 in January 1971 the computer mistakenly assigned my call sign to him and removed my data from the machine. When I renewed my license in June 1972, Paul's data was in turn removed from the computer with the resultant error of both of us having been issued the same call sign.

By now Paul has probably been issued another call sign and hopefully there ends the tale of two calls. There must be a moral to this whole thing, but I'm not about to probe that area.

Dick Hathaway W8KID
Whitehall MI

FCC NO JOKE

When the FCC dropped the bomb last fall (Docket 18803), commonly called the new repeater regulations, I was aghast. I wrung my hands in anguish, thinking of all the money and energy we had expended in our repeaters. I had visions of 75% of the repeaters going off the air on June 30th.

Then the idea struck me — it was so obvious, I had to laugh. It was the most ingenious April Fool's joke ever devised.

I listened as the weeks went by to the cries of outrage on 94 and 76, snickering to myself and feeling somewhat guilty for not letting them in on the big secret. With tongue in cheek, I agreed with the cries and moans I heard in the QSO's. In times of doubt I reassured myself with the fact that these were grown men at the FCC, full of respect and admiration for the amateur service. I had to be right or else the only other plausible explanation was a collective loss of sanity. Nonsense!

As April 1st neared, I could hardly contain my mirth and excitement. The big day arrived — I watched the early TV news, and there wasn't a word. The noon news and hourly radio broadcasts came and went and still there was nothing. The Sunday newspaper arrived; I searched it page for page, and not a line. It was perhaps too inconsequential for the news wires.

That evening I went downstairs and copied the MARS RTTY broadcast and there wasn't a word. W1AW was completely silent on the subject. Well, it was Sunday; maybe it was inappropriate to pull such a monumental joke on the Lord's Day.

All day Monday the ritual was repeated and still no word. But there was still hope — it was probably being held up for a first line article in *QST*. Finally, *QST* arrived, and with frantic fingers I leafed through the pages. Not one word about it. Still there was hope — if it was in print at all, it would be in *73*.

The new issue of *73* arrived and again I scanned page by page only to find that I had searched in vain. I hung my head, my shoulders sagged. It was true! The FCC had lost its collective mind! God help us all!

Bob Hileman WA8SSM
Weirton WV

HELPING HAM NEEDED

I have recently acquired a piece of Navy surplus gear which was made by Hammarlund. This particular piece of gear is a receiver, type CHC 46140, model 4BG 2, with a frequency coverage of 54 MHz to 31 MHz. The physical layout of the receiver suggests that perhaps it might be a predecessor of the present HQ series.

First, would you perhaps happen to have a schematic of this receiver in some of your back files? If not, could you tell me where I might find one? As a subscriber to *73*, I have seen many ads for surplus; perhaps some of these places could help me.

Lt. Scott Shannon WA5CVI/7
4216E Mountain Village
Mountain Home AFB ID 83648

CB'er SPEAKS

Being a CBer myself, I can agree with the letters you receive about the unauthorized use of the 11 meter band by about 90% of licensed operators.

The only way I can see the practice of using CB as a hobby is completely close the band, or require a special license for "bootleggers." Say $50 + $10 a watt.

Keep up the good work. Who knows, I may learn enough to pass the Novice test some day.

Sp6 Paul R. Harrison
Tacoma WA

How to understand the Government — remember, they don't have anybody selling the same thing cheaper on the next corner.

W1QLD

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

LOW-COST 220 MHz SIGNAL GENERATOR

This article describes the design and construction of an easy to build, inexpensive, crystal controlled signal generator for the 220 MHz band, including a very low cost attenuator that goes from a quarter volt down through 1/20th of a microvolt and on to a real zero (of rf power). It is very useful for receiver front-end tuneup, low noise tests, and as a portable field generator for overall antenna tests through the receiver. For signal identification purposes, af and FM modulation are included.

If you really want to fight for a low-noise front end, this piece of equipment will be of great assistance to you, because the attenuation really is infinite and without any difficult bypassing or shielding.

Design of the attenuator.

Infinite attenuation is achieved here by the use of a 50¢ piece of aluminum tubing, as shown in Fig. 1. You cannot drive 220 MHz signals more than a few inches down inside of a piece of aluminum tubing. By putting *everything* – battery, on-off switch, circuit and all – on the movable generator strip and sliding it in and out of the tubing, you avoid all touchy, difficult and expensive bypassing, costly attentuator pots, shielding, etc., and provide a simplified means of varying the attenuation with stable, smooth, easy repeatability. Calibration is of the slide rule variety and also simple as far as writing down the microvolts on the scale is concerned.

This principle is older than radio tubes; in fact Sir Oliver Lodge used it in his 1890 microwave work.

Attenuator Construction Details

Figure 1 tells most of the story, with details in Figs. 2 through 9. An adequate rf

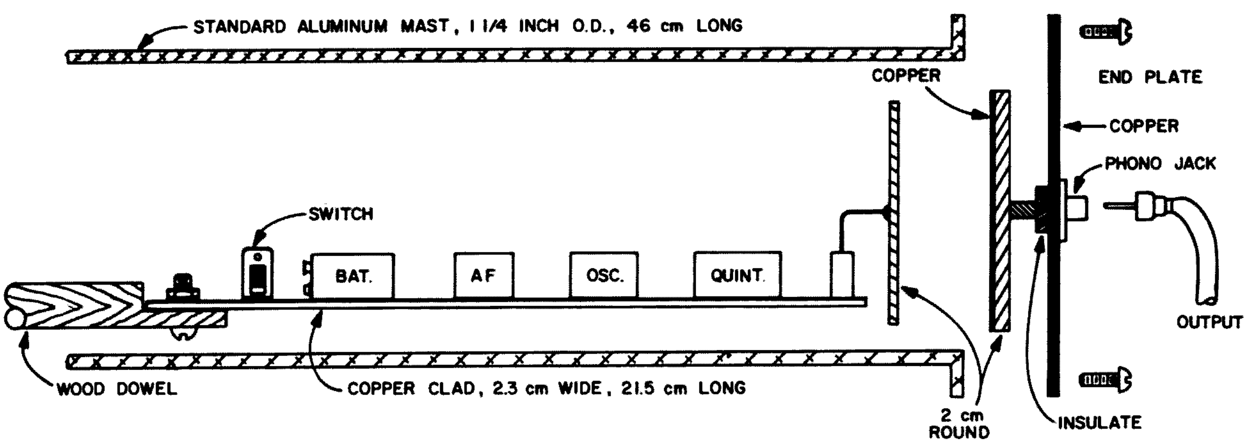


Fig. 1. Sideview, 220 signal generator and infinite attentuator.

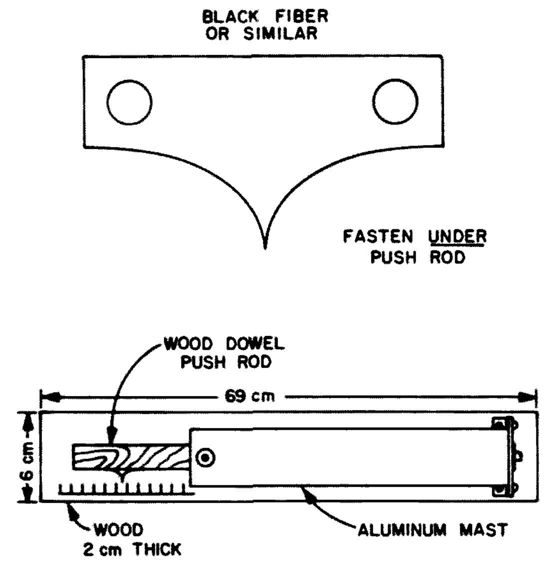


Fig. 2. Top view of the 220 signal generator and details of the calibration pointer.

seal can be made at the pickup end of the aluminum tubing, standard TV masting, 1¼ O.D., by 2 or 4 tabs in one end as in Fig. 3 and bending them back as shown, then cutting off the excess tubing. Install the pickup, plate, output jack, and end plate as shown in Fig. 1. I used time-saving external mounts for fastening it down to the wood baseboard as shown in Figs. 2 through 5. Drill a ¼ in. hole for a screwdriver as in Fig. 2, and use angles for the pickup end. Figure 2 also shows the scale in use for attenuation settings, and Fig. 3 shows pointer details. Figures 6 and 7 show pictorials of the layout, top view and side view.

The Generator

Nothing too fussy here, but attention to details will assure reliable af and rf oscillation at low power and low battery drain and good frequency multiplication. Figure 8 shows the schematic with the details of the two oscillators, the crystal in the 44 MHz range, and the quintupler. The af uses a standard circuit which, however, has one item to watch. Contrary to a transformer coupled circuit, which is seldom mentioned, this twin-T job has a nasty trick of not starting every time. However a small cap from collector to ground cures this and makes it 100% reliable in that respect. The emitter being grounded, I suppose this establishes the correct in-phase relation with the collector, in which both of these elements should be in phase. You can put a small trim pot af gain control between the modulator and the oscillator if you wish, watching out for dc voltages of course. As shown here, there is plenty of modulation for signal identification, both AM and FM.

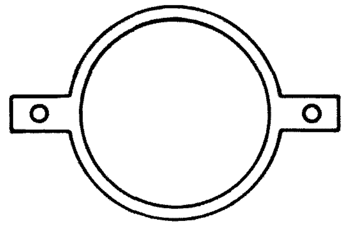


Fig. 3. Cable end view tubing.

Referring to Fig. 8, at the left is the af oscillator. It is not down symmetrically, but you can note the two 22K resistors and the two .02 frequency settling caps, along with the .05 and the 2.2K terminating the lines. All of these set the frequency, and to change the frequency you should vary all of them in at least their approximate present ratios. It is around 500 cycles as shown. Do not forget the "starting cap" from collector to ground.

This audio is fed to the base of the multiplier where it provides some AM and some FM modulation for signal identification purposes. When working with receiv-

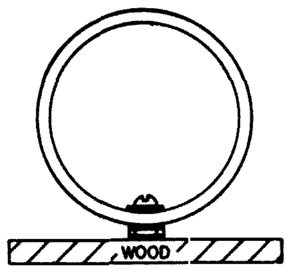


Fig. 4. Open end view.

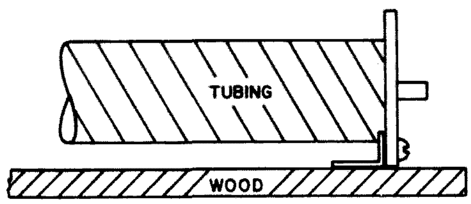


Fig. 5. Side view.

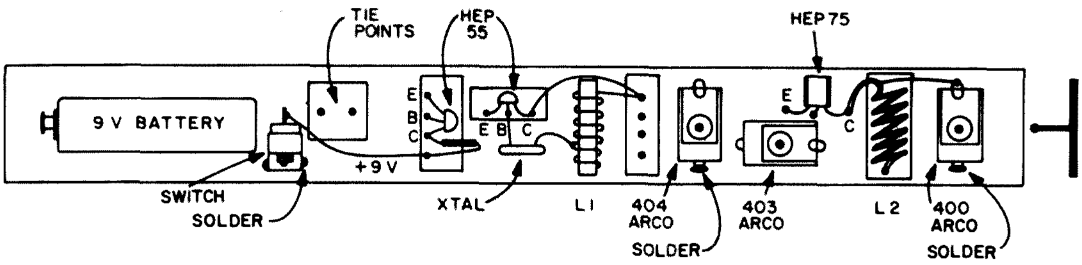


Fig. 6A. Layout, top view.

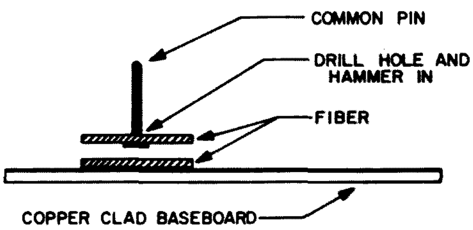


Fig. 6B. Tie-point construction.

er oscillators, and in particular with high-ratio multipliers, this is very important. It may also be locked into any old scope sync for noise figure and sensitivity comparisons. The scope sync gives a reference point where the signal to noise ratio will always be the same, without resorting to guess work. The crystal oscillator is my old tried and true crystal phase-reversing job, which uses negative feedback from the collector coil, which, after going through the crystal, reverses phase and becomes positive, thus assuring oscillation but *only* on the crystal frequency. A HEP 75 (similar to the famous 3866) is used for the quintupler. A lot more output is noted with this powerful but smooth operating old faithful, still good to 450 MHz.

The output goes to the antenna plate on the forward end of the baseboard plank. When this plate is moved all the way in so that it is only ¼ in. from the cable pickup plate in the end of the aluminum tube, a full scale reading may be obtained on a 50 microamp meter on the output of a tuned diode detector (see Fig. 9). My first model here has marks on the scale (see Fig. 2) for 1 rf stage; 2 rf stages; mixer (feeding into a good i-f strip); mixer plus 1 rf, etc. At the 1 rf plus mixer, you begin to hear all the repeaters within 100 miles or so. With 2 rf plus mixer (followed by a sensitive i-f of course) you are really getting sensitivity. This is where you put a scope in line in order to have an electronic comparison point for signal coming out of the noise purposes, and then can really get into the low-noise bit, if you have a hermit location. Just happens I have one here. When I hear the noise of a car, it's a visitor!

Output

You will see for yourself as soon as you start testing that the attenuator is smooth-working and stepless, and that true infinite attenuation is at hand. An rf input state (pre-amp) with a noise figure a fraction better than another shows right away on the

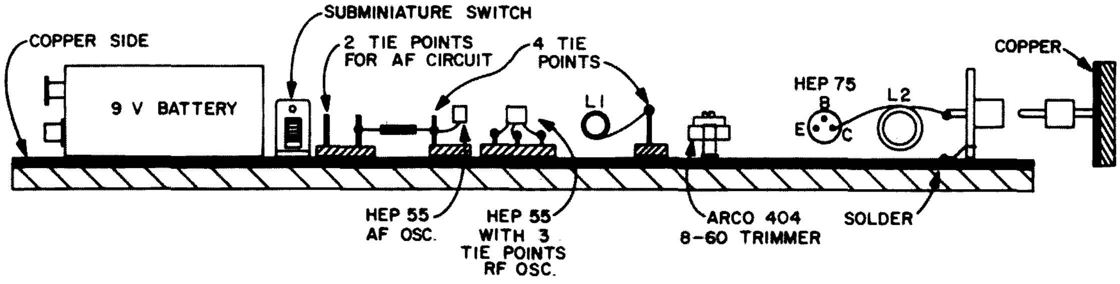


Fig. 7. Side view of the signal generator, 220 MHz.

scale. For example, adjustment of the fixed bias voltages on the two gates of a 3N200 or 3N201 shows right away on the scale as the push-rod is moved in and out and the signal is locked onto the scope. This work you can do right on the bench and at low cost.

There is quite a bit of mechanical work in the unit, depending on just how much "finish" you want it to have. You can also bring a dowel rod for "on and off" use. Do not, under any circumstances, bring out a *conductor*. You *can* do this, but only with

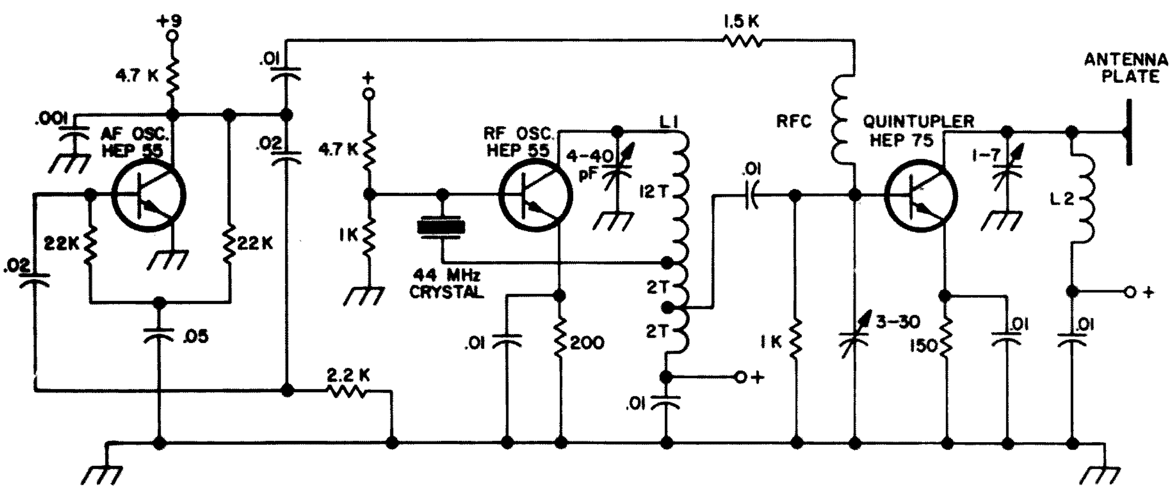


Fig. 8. Schematic. L1 = 16 turns No. 26 output tap at 2 turns, crystal feedback tap at 4 turns, from cold end. Wound on phenloic form .6 cm O.D. L2 = 6 turns No. 18 bare, air wound, .6 cm O.D., 2.5 cm long between tie points. RFC = about 40 turns No. 40, on phenolic form .3 cm O.D., 1 cm long (not critical).

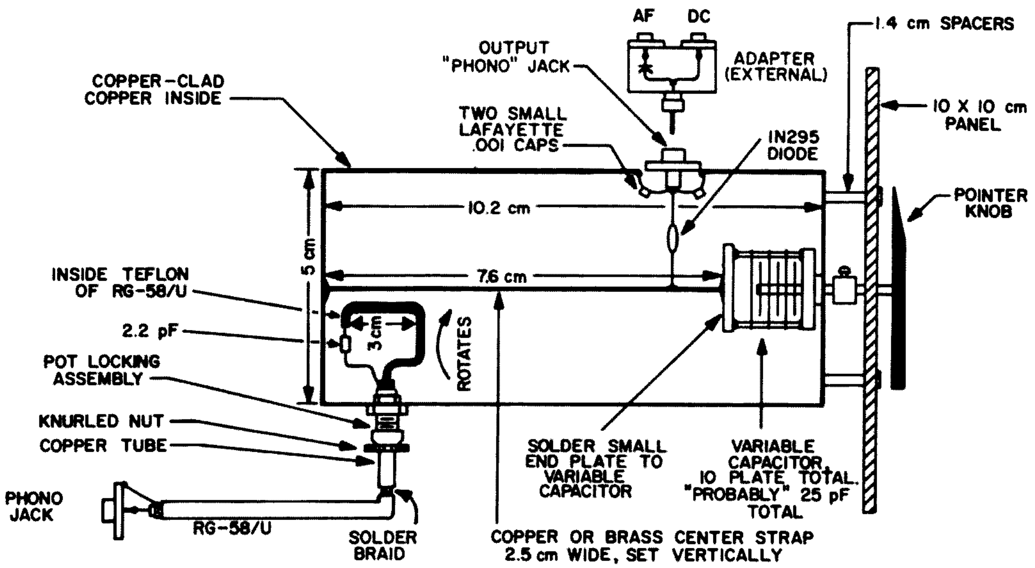


Fig. 9. Tuned diode detector, 160–460 MHz.

an extreme amount of filtering, which is not part of this article. Be sure to set up the baseboard, antenna plate and battery first, and get them working mechanically. With a drawn-out shape like this I generally start with a longer piece of copper-clad than needed, build from one end, and then cut off what is left over. Understandably, once you have made the first one you can always see, after it is done, many ways of improving it. However, someone has to make the first one, and that's generally my job.

Antenna and Field Tests

Out of the tubing, and with a small antenna connected via a one turn link around the quadrupler coil and then to ground, returning L2 for maximum output, this little rig puts out a lot of signal on 220. Especially if you reduce the oscillator emitter resistor! Up to several volts of rf can be obtained in a tuned diode receiver if you push things along, which is around 5 to 10 mW. If you place this generator out in a field several hundred yards or more away, you can then line up your antenna on the car or house, check antenna cables, antenna input alignment, and match or mismatch for lowest noise figure, etc.

Front end alignment should first be done with a relatively broadband i-f strip on 10.7 MHz. Be sure nothing metallic on the generator strip protrudes enough to touch the inner wall of the tubing, or "scratch" will occur in the high gain receiver. A piece of thin fiberglass or other insulating sheet wrapped around the whole generator movable plank is a good precaution.

Once again I include a 220 MHz tuned diode detector, which is an absolute must for frequency multiplication, especially quintupling and such, where the other unwanted harmonics are as little as 20% away from the desired frequency. Figure 9 shows this piece of test equipment in pictorial schematic form. Remember, shape is of considerable importance as you go from VHF into UHF. It is quite easy to make the square trough line out of an old piece of copper clad. Or even a new piece! And this particular one described and shown in Fig. 9 goes very well to over 450 MHz and thus is very nice for the next band also. If you make it just as I've shown it, it will do a good job for you.

Calibration will present some difficulties, so line up some other lads around who are already on these bands and get your calibration that way.

So good luck, friends, more coming – lot's more! Keep reading.

. . .K1CLL

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AN EXPERIMENTAL MINIATURE ANTENNA for 40 to 80m

Active, subminiature antennas have been publicized in many technical journals recently. Here is discussed the nature of such antennas and their applicability to amateur radio usage. An experimental antenna developed by the author is also described.

The term "active antenna" has come into usage recently to describe antenna forms which use semiconductor elements as an integral part of the antenna structure. Probably every reader has seen photographs of some form of this type of antenna where an antenna a few inches long is claimed to have the same performance (for receiving purposes) as a regular antenna of 10 to 20 times the size.

Whether the performance which is claimed is really true or not is still a question debated by many scientists and engineers. It would appear to be simple enough to take such an antenna and switch a receiver back and forth between it and a regular antenna for comparison purposes. However, such tests still leave many questions unanswered because the active elements in the antenna alter the noise figure of the entire receiving system. Therefore, the question remains of whether the active elements in the antenna really act to produce a new type of antenna form or simply act as a sort of very low noise level preamplifier for the receiver.

The purpose here is not to make any definite judgment about active receiving antennas. I do not advance any claim to having solved any of the scientific questions regarding the true value of active antennas. However, such forms of antennas do present a tremendously interesting opportunity for amateurs to experiment with antenna forms since only simple materials and components are necessary. Once one has constructed an active antenna that performs as well, or nearly as well, as a full-size antenna, one can really appreciate the scientific confusion that such antenna forms can generate.

Why Build an Active Antenna?

A logical question to ask is what value an active antenna would be. Even if one

could wire together a few transistors and a few pieces of wire a few inches long that duplicated the reception results achieved with a 30–40 ft wire antenna, of what value would the antenna really be since the full-sized antenna is necessary for transmitting purposes anyway? If one were engaged only in receiving operations, the value of such an antenna is clear, but there is also a good reason for using such an antenna even when a full-size transmitting antenna is available. That reason is directivity. Often, particularly on the lower frequency amateur bands, almost any good receiver has all the sensitivity available that is useful. Contacts are lost or DX stations not heard because of QRM. Selectivity devices within the receiver can be used to eliminate QRM to a degree, but relatively few amateurs also have available rotary antenna arrays, so antenna directivity can also be used to null out QRM sources. A small active antenna gives rise to the possibility of having available a small, easily rotatable antenna for receiving purposes that can be used to improve reception by means of its directivity. Such an antenna might be used indoors or outdoors, to replace or supplement the full-size transmitting antenna for reception purposes.

Definition of an Active Antenna

When an antenna design is that of an active antenna instead of just a short antenna with a preamplifier is sort of a moot question and perhaps the question at the base of the overall discussion on the value of active antennas. As shown in Fig. 1, one can visualize the question starting with the placement of an auxiliary preamplifer stage immediately at the input to a receiver at the terminals of the antenna, or within the antenna structure.

The role and performance of the preamplifier when placed immediately at the receiver, or at the terminals of a conventional antenna form are clear – as long as the input and output impedance levels of the preamplifier are known and are constant. Generally speaking, one converts from the conventional role of a preamplifier to an amplifier used as part of an active antenna when the amplifier also

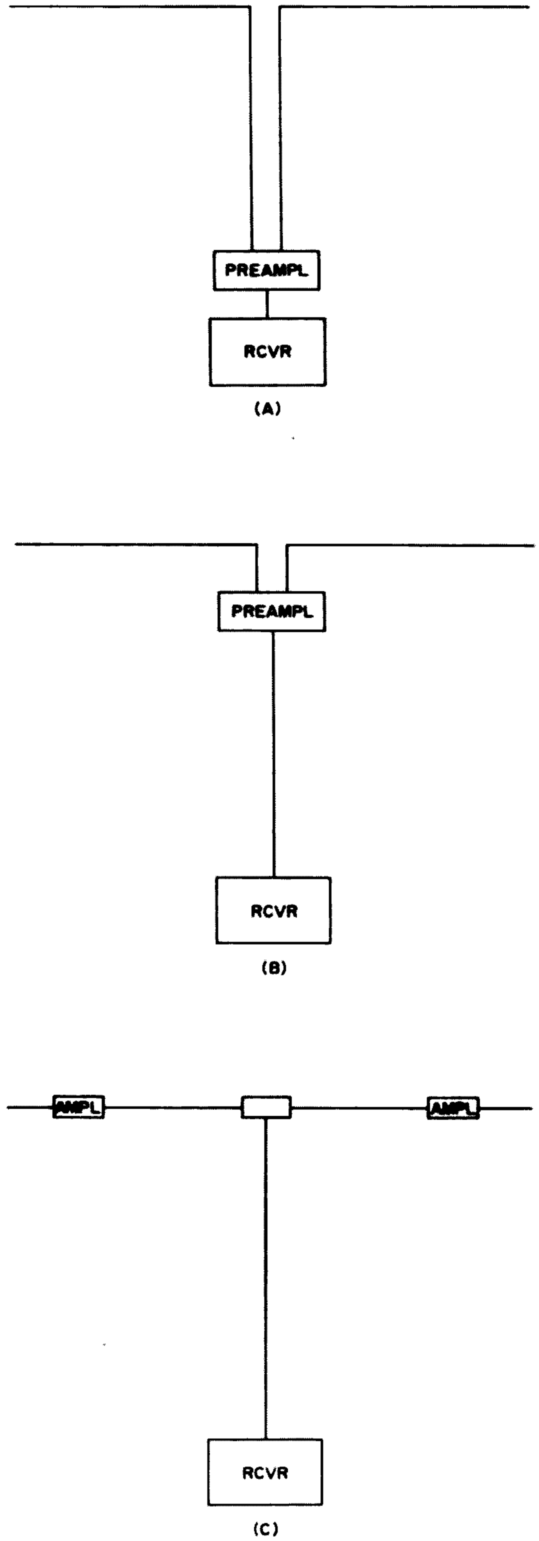

Fig. 1. The term "active" antenna does not have a rigorous definition. However, it can be visualized as a progression of the idea of using a preamp before a receiver (A) and (B). In the active antenna (C), the active device is part of the antenna structure and may act as a matching device as well as an amplifying device.

performs a matching or coupling function either at the base or internally to an antenna form. If the active device can perform this function over the impedance range necessary and in a very efficient manner, one can develop a physically small antenna that will perform the same as a full-size antenna. If one goes back and reads over basic antenna theory, it will be found that theoretically the signal pickup possible with a very short antenna, say 0.1λ, is essentially the same as that possible with a 0.5λ antenna. The reason the 0.1λ antenna does not perform as well in reality as the 0.5λ antenna is that power cannot be as efficiently extracted from it because of the loss in matching circuits. The active elements in the active antenna are supposed to perform this function in an efficient manner, not just act as a preamplifier.

Active antennas can take a variety of forms – there are few ground rules to go by. Most of the forms which have been developed have been developed on a strictly experimental basis and it often seems that the more detailed, scientific explanation of why an antenna works is developed after an experimentally derived form proves interesting. So, an amateur interested in experimenting with such antennas need not feel inhibited because of any lack of detailed knowledge of antenna theory. The antenna described next, which I developed for experimental purposes, is one example of an active antenna form.

An Experimental Active Antenna

Figure 2 shows the circuit of an experimental active antenna that I developed as a single-band antenna for use on the lower frequency amateur bands. The main features of the antenna are its relatively small size, directivity, and the use of two low-noise MOSFET stages. The basic scheme of the antenna was to use a tuned loop of relatively low Q for broadband operation over one amateur band phase coupled via a FET to a "sense" antenna for a unidirectional reception pattern.

As can be seen from Fig. 2, one 3N142 FET is used at the apex of the loop to couple the loop to a short vertical antenna.

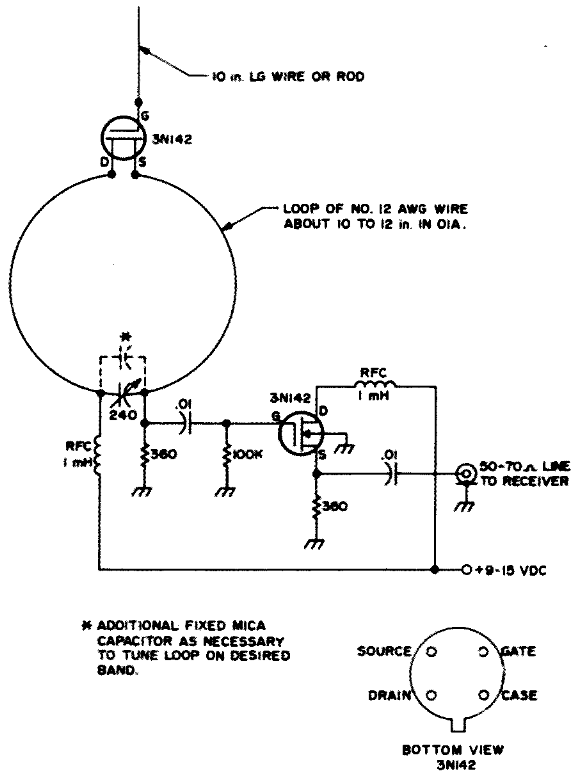

Fig. 2. Diagram of active antenna which author experimented with for use on 80 or 40 meters. The design is strictly experimental but seemed to yield very useful results.

The loop is tuned to 80 or 40 meters by the trimmer capacitor at the base of the loop. The tuning is quite broad because the drain–source resistance of the FET at the apex of the loop is in series with the loop. The trimmer capacitor also serves the function of dc voltage isolation, since the drain potential is routed to the FET over one side of the loop. The other side of the loop is brought to ground via the source resistance for the FET. The signal output from the loop is therefore achieved with the FET at the apex of the loop acting as both a coupling stage and an amplifier with a source-follower output. The output of the loop is coupled to another 3N142 FET used as a source-follower stage. This stage is used to isolate the output of the loop from the heavy loading effect of the 50Ω transmission line to a receiver. The current drain of both FET stages is very low (a few

milliamps) and can be supplied from any battery source of 9–18V.

My original antenna for low frequency bands was of experimental construction. Later on, perforated board was used to mount the components and to act as a vertical support for the antenna. There is no need to shield the stage at the base of the loop. The only tuning adjustment for the loop, the trimmer capacitor at the base, can be peaked under actual reception conditions.

The actual reception results with the antenna were a mixture of interesting observations. Compared to a full-size quarter-wave vertical on 40 meters, the antenna delivered signals only about an S-unit lower! However, the "active" antenna was used directly on top of the receiver indoors while the vertical was mounted outdoors in a clear field. On 80 m, the active antenna performed about the same as compared to the 40m quarter-wave vertical base-loaded for use on 80m. The active antenna exhibited fair to good directivity. The back null, as one might expect from an antenna with a cardioid pattern, was not as sharp nor as deep as usual. The front-to-back ratio was in the order of 10–15 dB. Such a ratio certainly is useful for QRM reduction, but is usually better with a full-size antenna. By varying the length of the 10" rod at the apex of the loop it appeared possible to also optimize the directivity on any given band.

Summary

This was my first experience with the actual construction of an active antenna, although much study had been done on such antenna forms. As is perhaps usual with any instance of actual experience versus studied time, some surprises were experienced. The active antenna performed surprisingly well, even though it was crudely constructed. To see a relatively small antenna deliver almost as good reception as a full-size antenna is quite surprising. The directivity of the active antenna could certainly be better and this direction in experimentation may prove to be the most fruitful since the basic signal pickup of a small active antenna on the lower frequency bands seems to be more than adequate.

...W2EEY

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AN IMPROVED UHF POWER OUTPUT METER

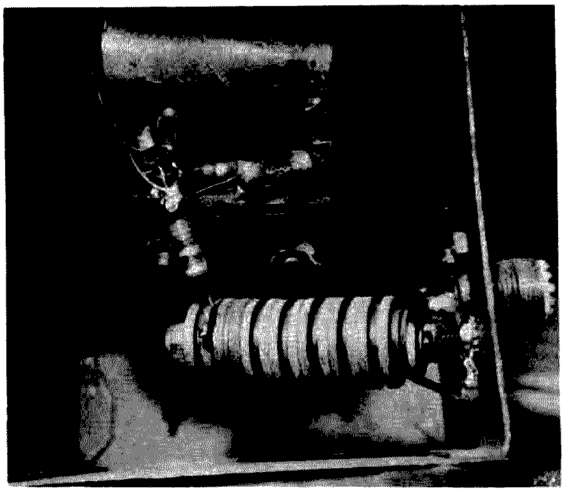
On page 207 of the *Handbook*, 1972 edition, in regard to a description of a simple varactor tripler for 432MHz, is a statement out of context: "Most constructors will find they have to spend more time making test gear to check the varactor than in building the multiplier itself. . .most of the dummy loads available to amateurs are too reactive at 432 MHz to be any good . . . A power indicator is the hardest item of all to come by."

This article will describe a UHF power output meter which is relatively non-reactive (vswr less than 1.5:1.0 at any point in range), will take the average ham less than two hours to construct once all parts are available, is not difficult at all to come by, and is relatively inexpensive compared to any commercial product offered on the market today.

Back in 1948, when the cheapest rf power output meter on the market sold for $185.00, I developed a reliable, accurate rf power output meter which could be home brewed by any amateur for less than $20.00. (*Radio & Television News*, April, 1950. J. A. Houser, "RF Power Output Meter for VHF and UHF.") This original meter was good from 3 to over 300 MHz, with a standing wave ratio of less than 1.5:1.0 over the entire range – quite exceptional for the state of the art at that time.

Since then the state of the art in measuring rf accurately and effectively has advanced slightly. Therefore improvements were made to the original meter and some changes incorporated to extend the frequency range to past 500 MHz; which meant that almost complete redesign and some cautionary factors had to be observed in the use of such a meter. One purpose of this article is to describe these changes and improvements.

The first factor or redesign in order to extend the UHF frequency range was the length of the resistance unit, which in the original meter consisted of two stacks of



25W single range meter, good to over 500 MHz.

silver-plated composition discs, the total length of which was 7 in. Simple computation shows that the stack length must be reduced to much less than this to obviate resonant conditions which appear when the resistive element approaches ¼ wavelength; the 7 in. original stack would resonate at approximately 375 MHz more or less, and this *resonant factor* is of predominant importance in the design of any rf load.

For one thing, when the rf path approaches ¼ wavelength, research work done in our laboratory showed that very strange things occurred, and the meter became erratic to say the least. As there was no literature available which described such things, they had to be learned by experimentation. It was also determined that an erratic area appeared with certain lengths of the RG-8/U connecting cable used to connect the meter to the transmitter. As long as the cable was kept under ¼ wavelength, no erratic conditions occurred, but when it approached ½ wavelength, unreliable operation resulted. Therefore the length of the connecting cable (with regard to the frequencies to be measured) is critical to some degree.

It therefore becomes mandatory that above 300 MHz the cable length should not be greater than about 4 in.

The meter described here is capable of dissipating 25W for up to 30 seconds without undue heating or change of resistance values of the discs, and up to 50W for not more than 5 seconds of intermittent use. This is entirely adequate for tuneup procedures of a transmitter in the 300 to 600 MHz range, as most of these transmitters in the present state of the art have power limitations of 25W or less.

The picture shows the simple, straightforward, short lead construction employed. Note how close the resistance stack is mounted to the input connector (actually, right on it). The ground lead is less than 1/8 in. long, and the high rf lead is actually but 3/8 in. long. A 1N38 diode was found to have a more linear, higher frequency range than the 1N34 diodes originally used, but the 1N34 can be used if that is all that is available, and it will work (however the forward to back ratio of the 1N38 is quite superior to that of the 1N34).

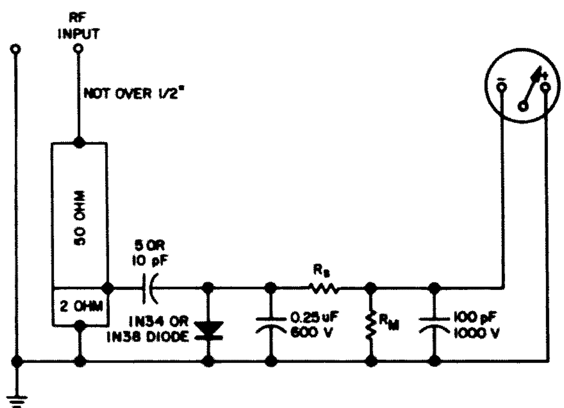


Fig. 1. Circuit schematic.

The parts list which follows is specifically made flexible to adjust to the type (sensitivity) of the meter which the constructor chooses to use, within the ranges specified in the charts:

5–10Ω composition resistor discs
1–2Ω composition resistor disc
2 takeoff tap washer/connectors (see diagram)
1 1N34 or 1N38 diode (or similar)
1 μF mylar capacitor
1.025 μF mylar capacitor
1 R sub s (series) resistor (see table)
1 R sub m (meter parallel) resistor (see table)
1 100 μF capacitor (mica preferred) (meter shunt)
1 meter (constructor's preference)
1 meter and instrument enclosure (Bud or similar)
1 SO-239 chassis connector
4 #6 x 1/4" flat or filister head brass NP machine screws, 32 TPI
Solder and #12 copper connecting wire as required; (about 4" will do)

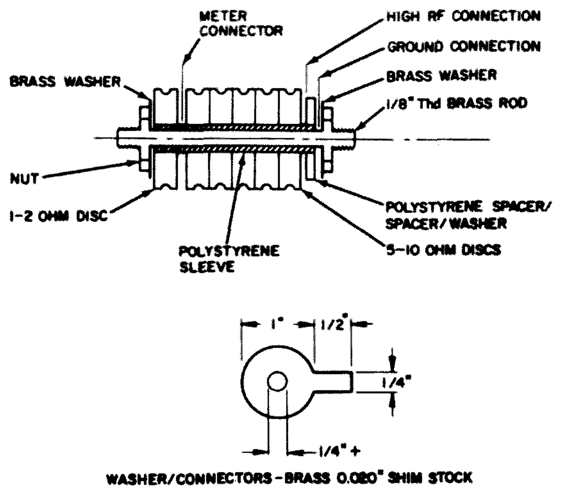


Fig. 2. Split view drawing of the resistor stack assembly.

Several bugs were encountered in the design of this new meter. It was found that there appeared a time-constant effect when an attempt was made to design a dual-range meter (high and low power). This appeared *only* when R sub m and R sub s were made approximately equal in value. As mentioned previously, there is no literature available to act as a guideline in design such as this. However, it was found that the reaction mentioned was taking place in the dual-range switch which was being used, so the dual-range feature was discarded, and a single-range meter was the only solution.

Because the constructor may have various usable old meters of different types around the shack which may be used, Table I is presented showing the values of resistors which can be used with various types of meters. The values are not strictly arbitrary. Nearby values, and a little cut-and-try will result in a meter with a range of power output suitable to the constructor, with a minimum of cost.

It should perhaps be mentioned – and may be of interest to some – that this meter *can be used* in pulsed transmissions and it will *read*; but caution: The reading will be false, and will have to be interpolated against the time on/time off shape of the pulse; and it will not be completely linear, at that.

Over 1,000 sets of elements described in the original meter were dispensed to constructors from the southern tip of Africa, to Alaska, England, Spain, China, Siam, and just about *all* states and possessions; probably because they could be mailed first-class postage; and only two builders had any difficulties, which eventually were straightened out.

In the redesign of the meter, new type discs were secured which are actually larger than the 1 in. disc diameter of those shown in the photograph. Five 10Ω discs, and one 2Ω disc are used in the "stack" to make up exactly 52Ω rf resistive impedance.

The metering/rectifier circuit is taken off at a tap between the 2Ω disc and ground. This results in just about the lowest practical impedance which can be used to feed the rectifier/meter circuit. The meter shown in the photograph was designed to read 20W full scale; it has been used by me for a number of years to test the output of 2-way transmitters (mobile) used in taxi and police cars which have maximum power output of 20W. The original meter is good for up to 100W up to 300 MHz and has been used by me to check fixed-station transmitters used in 2-way work for the past 20 years – and it is still in use.

A caution about parts: Use only the best quality components – such as a 1,000V mica capacitor across the meter, and if possible, a Mylar type capacitor as the rectifier shunt (0.25 μF/60-V type). The coupling capacitor, which should be a 5 pF/1000 for frequency range up to 600 MHz must of necessity be of the deposited silver-on-ceramic type, as that is about the only type available in this range.

The only other caution is with regard to the construction of the stack itself. The discs have a ¼ in. hole through the center of each.

TYPICAL VOLTAGE GRADIENT VALUES ACROSS STACK OF DISCS WITH FIXED RF INPUT**

Top of stack (input rf terminal)	6 Volts rf
Between 1st and 2nd discs	5.2
Between 2nd and 3rd discs	4.1
Between 3rd and 4th discs	3.0
Between 4th and 5th discs	2.5
Between 5th and 6th diss (Tap Point)	2.1

**From this table, note the slightly capacitive effect of the discs, which accounts for the nonlinearity of the rf voltages across the same values of resistances – 10Ω in each case except the last, which is 2Ω.

A 1/8 in. or No. 10/32 threaded brass rod is suitable for the center (ground) conductor. This is insulated from the stack by a length of 1/8 in. inside diameter polystyrene sleeve, which is just less than ¼ in. outside diameter, and fits nicely inside the inside bore of the discs. At the ground end (far end of the stack from the rf input) next to the tapped disc, no insulating washer is used. A brass or copper washer can be used, and then the ground nut, which should be brass or brass nickel-plated of the Castle type.

The high rf end of the stack consists of the takeoff copper washer/strap, which is to be connected to the hot terminal of the chassis connector, and then an insulating polystyrene washer at least 1/8" thick, then the ground washer/strap connector, a brass washer, and then a brass nut. Dimensions are given for the washer/connectors in the event the constructor wishes to make his own, if nothing suitable is available; also a split-view drawing of the stack is given herewith so the constructor will make no error in assembly. The ground rod (brass) actually extends through the center of the stack.

Any suitable meter case (such as bud) can be used. With all materials available, this meter can be constructed in much less than 1 hour. There are but 5 holes to drill. Position the input chassis connector at the side of the case (left side seems more convenient); drill the center hole; position the connector, and mark and drill the 4 small retaining-screw holes (#6/32-1/4" brass nickel-plated screws and nuts were used). One nut retains the ground connector which is soldered to the stack ground strap. There are only 11 soldered connections.

As a matter of information, the curious constructor might like to know what the voltage gradient would be between the 6 discs used in this meter. A General Radio rf VTVM was used to determine the voltages shown in the table herewith. Note from these readings that the very slight capacitive effect of the discs is apparent; which accounts for the non-linearity of voltages appearing across like 10Ω resistor discs.

METER USED FULL SCALE READING	R sub s	R sub m	WATTS FULL SCALE READING
1 mA	4,000	180	400*
	ZERO	180	10
7.5 mA	1,000	1,000	30
12.0 mA	2,000	1,000	-30- (at 3/4 scale)
200 mA (with shunt removed)	5,000	180	-30- (at 1/2 scale)
About 500 μA	2,500	180	-30- (at 1/4 scale)

* The value for 400 watts full scale reading is given; however, 400 watts cannot be applied to the meter described herein.

** Resistors near the values given may be used – cut and try – as the internal resistances of various meters do vary from published figures. The values given herewith are guidelines.

Testing the Meter

Now that you have constructed the meter, how about testing it just to convince yourself it is a good one? The best test of any such output meter is to make up a test line with a RG-8/U "T" fitting in the center of the line. Practically, two short lengths of cable may be made up, each 1/8 wavelength or less in length, and a screw type RG-8/U "T" fitting inserted. Then, cut yourself a piece of RG-8/U cable exactly 1/4 wavelength long at the frequency of the transmitter you are using. Insert this open-ended piece of cable into the "T" fitting, and connect the meter and the transmitter. Turn on the transmitter. The meter will read zero – that is, if everything has been cut exactly, or near zero if there has been a slight error. Now, with the transmitter off, short out the end of the stub of cable inserted into the "T" fitting. Turn on the transmitter and the meter should read exactly as it does with the stub completely removed from the "T" fitting (meter connected directly to transmitter).

To obviate too much computation on the part of the reader, it might be stated that the approximate lengths of 1/4 wavelength line in various frequency ranges are as follows:

150 MHz range – approx. 17½"
300 MHz range – approx. 8¾"
600 MHz range – approx. 4-3/8"

These figures are given as guidelines only. If your actual measurements with exact transmitter frequencies compute out too far away from these figures, you will know you have an error in computation.

. . .K2EE

REPEATER LICENSE APPLICATION INFO

As a guide to any amateur about to license a repeater, here is the latest poop from the FCC, with sample diagrams, etc. Appended is a section on antennas for repeaters, with a current list of commercially available FCC-approved antennas.

The opening section is a sample "Technical Explanation of the Operation of The Control Link." Be sure your name, address and phone number are on each statement or diagram you submit.

TECHNICAL EXPLANATION OF THE OPERATION OF THE CONTROL LINK

(refer to the functional block diagram)

1. Description – A wire control link is used between the control point and the remotely controlled station. It is used for control and communication purposes. The wire line consists of a dedicated twisted pair, 1 mile long, strung on poles. Command tone signals are transmitted over the wire line from the control point by the control operator to the remotely controlled station where they activate the desired control function.

2. Protection against unauthorized operation through physical access to the remotely controlled station – The remotely controlled station transmitter and control equipment will be housed in a locked building. Only other licensed amateur radio operators authorized by the station licensee will have keys to the building. Based upon

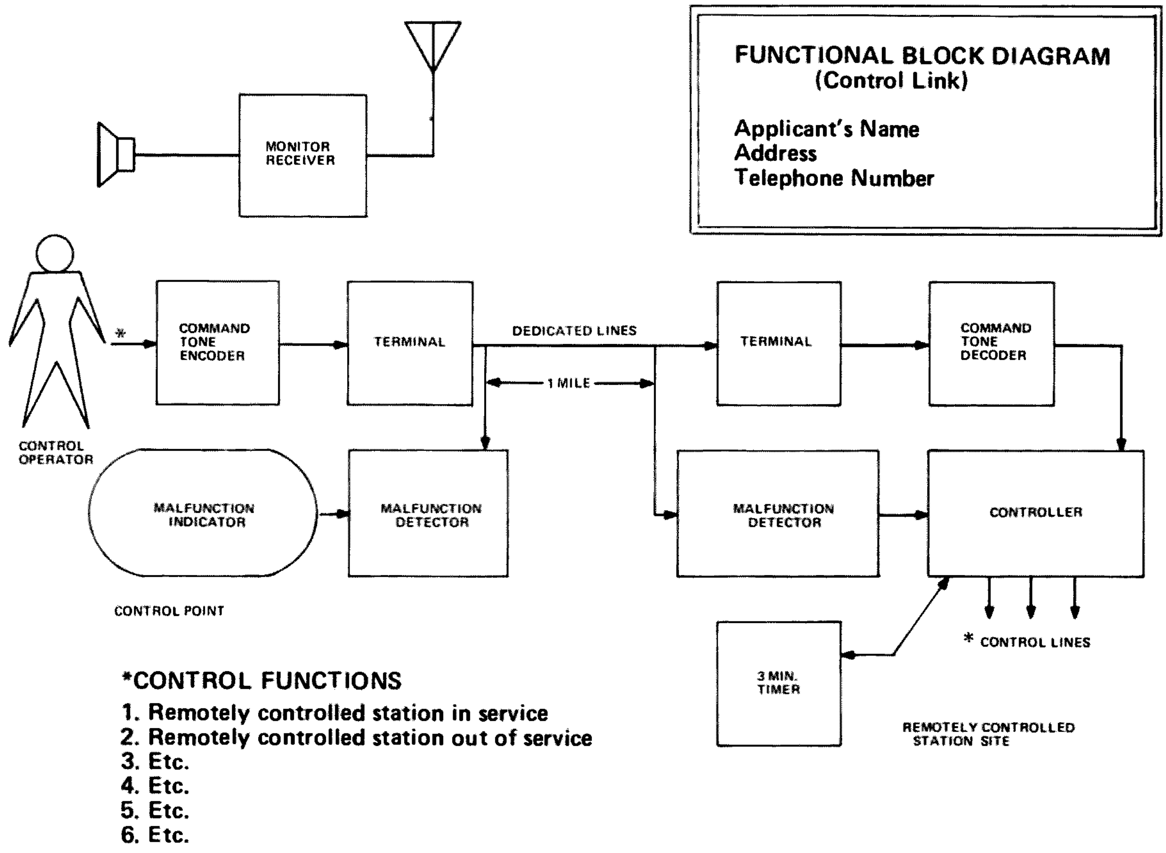


Fig. 1. Sample Functional Block Diagram, referred to in the sample explanation above.

my experience and knowledge of local conditions, I believe these precautions are adequate to prevent operation of the remotely controlled station by unauthorized persons through physical access to the equipment. In the event unauthorized emissions do occur, station operation will be suspended until such time as adequate protection is incorporated.

3. Protection against unauthorized operation through activation of the remotely controlled station through the control link — The command tone encoder and command tone decoder use a system of five sequential audio tones for each command. The tone frequencies and sequences are treated as privileged information and are not divulged to other than control operators authorized by the station licensee. The tones and sequence codes are changed periodically. Based upon my experience and knowledge of local conditions, I believe these precautions are adequate to prevent operation of the remotely controlled station by unauthorized persons through the control link. In the event unauthorized emissions do occur, station operation will be suspended until such time as adequate protection is incorporated.

4. **Malfunction** shut down — A malfunction detector monitors for the presence of a continuity current on the wire line at the control point and at the remotely controlled station. When an abnormal continuity current is detected, the malfunction indicator warns the control operator. If the abnormal continuity current persists for a minimum of 3 minutes, the remotely controlled station is automatically taken from service by the controller. The remotely controlled station can only be returned to service by the control operator through the control link.

5. **Monitoring provisions** — A monitor receiver tuned to the transmitting frequency of the remotely controlled station is located at the control point. Due to the proximity of the control point to the remotely controlled station, the control operator can monitor the transmitted signal of the remotely controlled station for proper operation, and can monitor for the presence of other signals the transmitted signal could interfere with.

MONITORING OF A REPEATER STATION

Section 97.111(b) requires that the transmitting and receiving frequencies utilized by a repeater station be continuously monitored by a control operator (c/o) immediately prior to, and during, periods of operation. For a station having the control point located at the station, the c/o can monitor the repeater input receiver prior to activating the repeater transmitter in order to check for the presence of signals not intended for retransmission. He could, either concurrently or sequentially, also monitor the transmitting frequency for the presence of other signals from stations the repeater station could cause interference to.

In the case of remotely controlled repeater stations, additional provisions will have to be incorporated when the control point is sufficiently far removed from the repeater station site, in order to facilitate proper monitoring. Either a wireline or a point-to-point radio link using an auxiliary link station at the repeater site to the control point may be required. Another method uses a receiver at the repeater station, tuned to the transmitting frequency for activating a lock-out circuit in the presence of another signal on the same frequency. In areas where there is normally no other signal on the repeater input frequency, the control operator can momentarily activate the repeater station and monitor the output for the presence, or absence, of signals not intended for retransmission by that repeater station. In areas where the presence of such signals is a common occurrence, such as where there is more than one repeater station using the same input frequency, it is necessary to employ a system of access signals to insure that such signals are not retransmitted.

SYSTEM NETWORK DIAGRAM

Definition — A System Network Diagram shows each station and its relationship to other stations in a network of stations, and to their control point(s).

Requirements — When application is made for a station having one or more associated stations, i.e. control station and/or auxiliary link station, a System Network Diagram must also be submitted. Control stations and auxiliary link stations may not be used to communicate with any other station than those shown on the System Network Diagram. A copy of the System Network Diagram on file with the Federal Communications Commission, Washington, DC, must be retained at each control point for a remotely controlled station.

The diagram must be in the form of an outline map, and does not have to be drawn to scale (see typical example). The relative location of every station and control point in the system network must be indicated by showing the approximate distance between stations.

Stations — Every station in the system network must be shown by a separate block, even if there is more than one station at a single location. Label each station as appropriate, i.e. repeater station, control station, etc. Also, there must be an indication for each station whether directly controlled, wire remotely controlled, or radio remotely controlled. Every control point for each station must be indicated.

Antennas — The frequency band, effective radiated power, and characteristics of the transmitting antenna, i.e. omnidirectional or directional, general orientation if directional, and relative gain over a half-wave dipole must be indicated for each repeater station, control station, and auxiliary link station.

Format — The System Network Diagram should be prepared and submitted on standard 8½ x 11 inch size

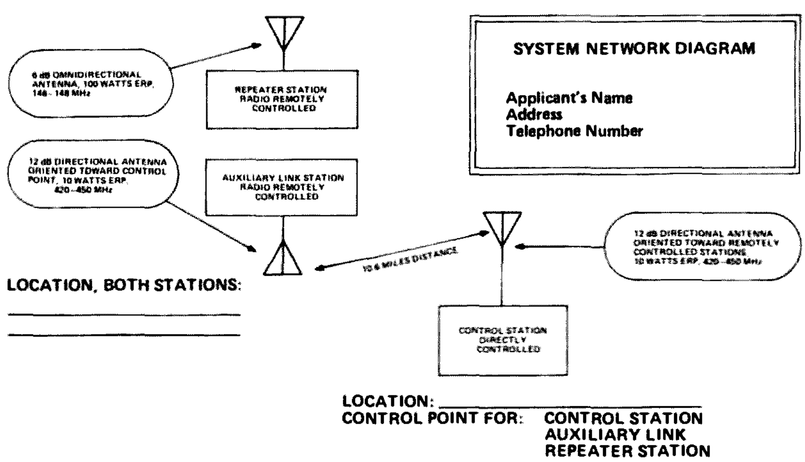


Fig. 2. Sample System Network Diagram (see text above).

paper. It should bear a heading identifying it as the System Network Diagram, and contain the applicant's name, address, and telephone number where the applicant can be reached in case clarification is required.

ANTENNAS USED BY REPEATER STATIONS

1. Rule reference – Section 97.41(f)(6) states that the application shall include

"The horizontal and vertical radiation patterns of the transmitting antenna as installed, with reference to True North (for horizontal pattern only), expressed as relative field strength (voltage) or in decibels, drawn upon polar coordinate graph paper, and method of determination of the patterns."

2. The term "as installed" in (1) above does *not* mean that measurements (if required – see below) must be made on the antenna in its normal operating position. It means that the measurements should be made with the antenna mounted in approximately the same position with reference to *a supporting structure* reasonably similar to that used in the intended location. If that is impossible (such as when an antenna would be mounted on a broadcast tower with a 12 foot cross section) a statement should be made to explain why it could not be done. The intent is to obtain pattern results which are *reasonably approximate* to those that *will obtain* when the antenna is mounted in its final position.

3. *When proposing use of a half-wave dipole,* it will be satisfactory to indicate that the gain is zero dBd (dB with reference to a dipole), and the horizontal and vertical patterns to be supplied, commonly contained in recognized amateur handbooks, will be accepted without computations or measurements.

4. When proposing *other than a half-wave dipole,* and the *antenna is not commercially manufactured, horizontal* and *vertical* pattern measurements should be made. In determining the patterns a total of *24 measurement points per pattern,* (6 per quadrant) will be satisfactory to determine the pattern shape. The test description should include a block diagram of the test set-up, brief explanation of the techniques used, together with information concerning the test equipment. Gain in the main lobe of the horizontal pattern may be determined either by computation, measurement, or a combination of both, expressed in dBd.

5. *When proposing use of a commercially manufactured antenna;*

(a) If the antenna manufacturer has submitted the antenna data to the Amateur and Citizens Division, FCC, and it has been approved, all the applicant needs to do is *specify the manufacturer, type or model number* of the antenna and the *manufacturer's specified gain figure(s)* in dBd. If you do not know whether the antenna has been approved, consult your manufacturer. *Do not submit patterns from the manufacturer's catalog for approval.*

(b) If a commercially manufactured antenna has not been submitted or approved by the Amateur and Citizens Division, FCC, and you wish to use it, proceed as in item 4, or refer it to the manufacturer for resolution of the data.

6. *Antenna showing for use in control and auxiliary circuits:*

Reference is made to the memorandum associated with the Report and Order, Docket 18803, numbered paragraph 15, last sentence which reads: "... The operation of a control station or an auxiliary link station which does not use directional antennas in conjunction with low transmitter power to minimize the possibility of harmful interference is not considered good amateur practice, and will be carefully evaluated by the Commission if proposed."

It is *not sufficient to merely state* the applicant will conform to Section 97.67(b) regarding use of minimum power to accomplish the purpose of the control of auxiliary link. The showing should indicate the link or control transmitter input power, line loss in dB, type of directional antenna to be used (dish, yagi, etc.), the approximate gain in dBd in the main lobe of the antenna, and a brief statement explaining the reasoning behind the power value proposed to comply with Section 97.67(b).

7. *General information of interest concerning antennas:*

(a) All references to antenna gain should be referred to a half-wave dipole and expressed in "dBd." Some manufacturers advertise antenna gain referred to an isotropic antenna "dBi" which is roughly 2.2 dB greater than when referred to a half-wave dipole. Sometimes this is not made clear.

(b) In rough, mountainous terrain where reflections and shielding may be a problem, it may be advantageous to utilize low antenna gain and higher transmitter power. Another technique which may be used to improve "fill-in" is circular polarization, where the radiated field may be considered composed of both horizontal and vertical components, produced by particular antenna configurations.

(c) For vertically polarized omnidirectional operation, typical antennas with substantial power gains may consist of phased elements (usually dipoles of some kind), spaced one wavelength apart in the vertical plane. Typical power gains in dBd of such arrays using vertical polarization, are as follows:

Number of stacked Elements	Power Gain dBd
2	2.9
3	4.9
4	6.2
5	7.3
6	8.0
7	8.8
8	9.3
10	10.4
12	11.2

(d) For the information of amateurs who wish to become informed about the techniques of antenna measurement in the commercial field, reference is made to a publication of the Electronic Industries Association, 2001 I (Eye) Street, NW, Washington, D.C20006, telephone: 202/659-2200, entitled, "EIA Standard RS-329, Part I, Base or Fixed Station Antennas." This publication may be ordered from the EIA at $2.00 per copy.

(e) The following antennas have been approved for use by amateur repeaters as of 13 April 1973.

Manufacturer	Type or Model	Gain
Phelps Dodge/ Communications Products	220-509 with various mounting configurations 144 MHz "Super Station Master"	5.25 dBd
Cush-Craft Corp.	AR-2 "Ringo"	2.0 dBd in horizontal plane
All with same patterns & gains. See 1,2,3	AFM-4D	6.0 dBd[1]
	AFM-44D	9.0 dBd[2]
	AFM-24D	3.9 dBd[3]
Hy-Gain Electronics Corp.	362/SJ2S4	5.9 dBd
	268/725	5.9 dBd
Andrew Corp.	161-3	2.8 dBd
	150 B-11	5.25 dBd

1. Elements spaced around mast.
2. Forward gain, elements mounted all on one side of tubular mast.
3. Back side gain with elements mounted as in 2.

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A SYSTEM FOR DIRECT VIEW COLOR SSTV

During the past year, I have been working on a method of viewing Color SSTV pictures directly from a monitor (no photography necessary). Although I am still developing this system, I feel the information I've obtained thus far should be shared with others throughout the world. Specific circuit details have been omitted since they would be similar to existing circuits (dc amplifiers, voltage controlled audio oscillators, bandpass filters, etc.). Only the actual "food for thought" is presented.

Our present Color Slow Scan system consists of converting a color picture into red, green and blue analyzed frames and transmitting each sequentially. At the receiving end, a multi-exposure photograph is taken of the monitor screen (as each color analyzed frame is presented) through the appropriate filters, thus reconstructing an equivalent color picture.

For direct view Color Slow Scan, the three color separation pictures, one red, one blue and one green picture (previously obtained from the color picture to be transmitted) are placed side by side in front of the camera, so all three pictures are scanned during each frame. This is transmitted, and Fig. 1 shows how they would be displayed on your monitor. Next, red, blue and green filters are placed over the appropriate pictures to reproduce the three basic color images. All we need to do now is to converge the three images onto a common viewing point. This may be accomplished by several

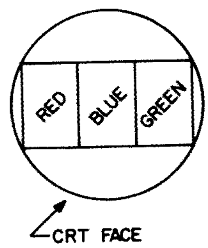

Fig. 1. The three "side by side" pictures as they are displayed on the screen of a monitor.

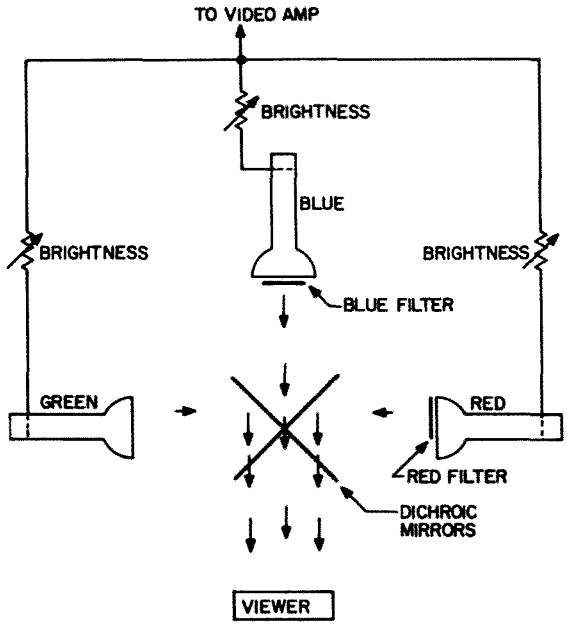

Fig. 2. Color SSTV photos may be viewed directly by using a crt for each color and joining the three images on a viewing screen via dichroic mirrors.

methods varying from a simple lens/mirror arrangement where you "stack" the two outer pictures onto the center picture, to the arrangement shown in Fig. 2. In Fig. 2, three electrostatically deflected tubes are slaved to one monitor. (Taggart, WB8DQT, described this procedure in the July, 1972 *73 Magazine*, page 93.) Electromagnetically deflected tubes could also be used; however, three yokes (with either heavy duty or separate sweep circuits for each yoke) would be required.

Looking at Fig. 2, a red filter is placed over the equivalent pictures on the right hand tube, while cardboard covers the other two pictures on the screen. A weak blue filter is placed over the center image on the center cathode ray tube, while cardboard covers the two outer pictures. No filter is used on the "green" tube, just cover the "red" and "blue" pictures. The red and green pictures now reflect off their associated color dichroic mirrors, while the blue picture passes through both mirrors and blends with the other colors to produce (or in this case, reproduce) a full color image at the viewer.

Color dichroic mirrors are unique in the fact they reflect only one color (like a red frame) while acting like a plain clear glass and passing the other colors (like a blue frame). Incidentally, I understand Dr. Edwin Land's new Polaroid camera uses dichroic mirrors in an arrangement somewhat similar to the previous description; however, I have not personally examined one.

Naturally, proper positioning of all three tubes (plus the viewer) with respect to the dichroic mirrors is necessary. The brightness control on each crt is for balancing the individual colors. This briefly describes the basic "system."

One drawback of this system is the low brightness of the blue picture after placing a blue filter in front of the P7s (primarily) green persistence. This can be corrected somewhat by "dimming" the red and green crt brightness pots. Four second frames also help overcome the dim blue picture by sweeping twice as often, thus giving a brighter picture to drive through the blue filter. The other drawback is small picture size; however this can be overcome by either a magnifier lens, larger screen crt (12DP7s are becoming popular on the surplus market and are a direct substitute for a 5FP7) or high gain separate sweep circuits for each crt. With a separate sweep circuit you could enlarge all three pictures, then re-center just one of the desired pictures to fill each crt screen.

Some time back, Jim Wilson W4RKS and I rigged a P31 phosphor crt to a Slow Scan monitor. Although the pictures were held on the persistence for only half a frame, the blue content was high. This phosphor, plus 4 second frames, would be ideal for the blue picture. I am still awaiting a P26 phosphor crt, so I can't definitely say what effect a blue filter would have on its persistence.

There are other possibilities, including "breaking down" our grey scale frequency range into three color ranges (plus guard bands). However that's a long discussion I will cover in the future.

I would be quite interested in hearing from others on either this or any related Slow Scan experimentation and/or development. You may write me direct, or via *73 Magazine*. Any significant accomplishments can be described in my SSTV Scene column.

. . .K4TWJ

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RTTY AUTOSWITCH

Reception of a 2125 Hz tone through the local FM repeater will automatically put your receiver on a specified RTTY channel.

The advent of two meter FM has seen the opening of new areas of endeavor for the amateur. Repeaters, autopatch, and many other innovations are made possible by the channelized FM system. This channelized system offers some advantages in local and regional radio Teletype communications. What could be better than a 2 meter FM channel for autostart work, local nets, traffic, or just plain amateur communications? The problem with this is that it requires constant monitoring of the Teletype channel at the expense of monitoring the local repeater or the construction or purchase of an additional receiver to allow simultaneous monitoring of both channels – or does it? In pondering this question, I wondered if there were some way to have my cake and eat it, too. That is to say, to be able to monitor the local repeater but with the capability to switch automatically to the local RTTY channel, should a station wish to send me a printed message. (Teletype is not permitted on the Rochester Repeater, WA2UWQ, for obvious reasons of courtesy to those stations monitoring or wishing to use the repeater.)

The result of this pondering is the autoswitch system. It meets the requirement for minimum annoyance to stations using the

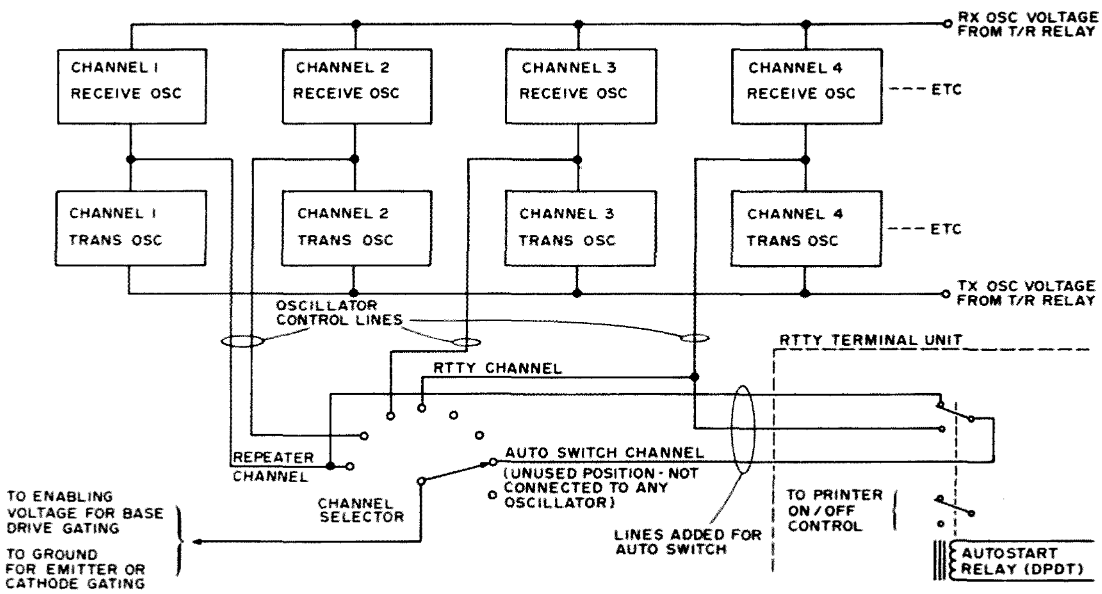

Fig. 1. Connections for autoswitch.

repeater, is extremely simple, costs next to nothing if your TU has autostart, and it works.

The technicality of autoswitch will not amaze you and it won't take a BSEE degree to understand the circuitry. Autoswitch makes use of the autostart feature in the terminal unit to automatically switch the 2 meter FM receiver to the local repeater output (in this case 146.88 MHz) when the printer is off or switch the receiver to the local RTTY channel (in this case 146.70 MHz) when the printer is on.

A station with a Teletype message for a station equipped with autoswitch merely checks in and out of the repeater, calls the station and follows his call with a three or four second mark (2125 Hz) tone burst. The tone burst causes all autoswitch equipped stations to turn on their printers, switch to 146.70 and wait for 20 to 30 seconds for the Teletype signal to appear on 146.70. If the signal appears on 146.70 before the 20–30 second delay time has elapsed the system will print the message received. If no Teletype signal appears after 20 to 30 seconds of listening on 146.70, the system automatically turns the printer off and switches the receiver back to 146.88 to monitor the repeater.

The only other requirement for autoswitch is that your FM receiver uses a dc oscillator gating technique (either a switch to a positive dc voltage or a switch to ground to enable the oscillator. Some receivers, like the Regency HR-2 series, switch the rf excitation to the crystal via a rotary switch.

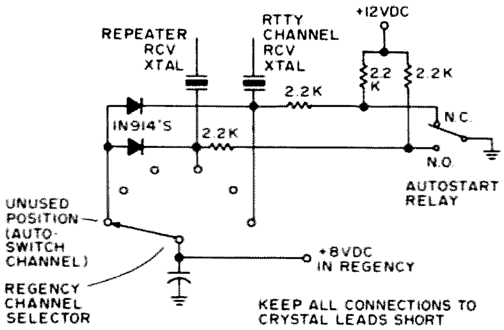

Fig. 2. Autoswitch modification for Regency HR-2

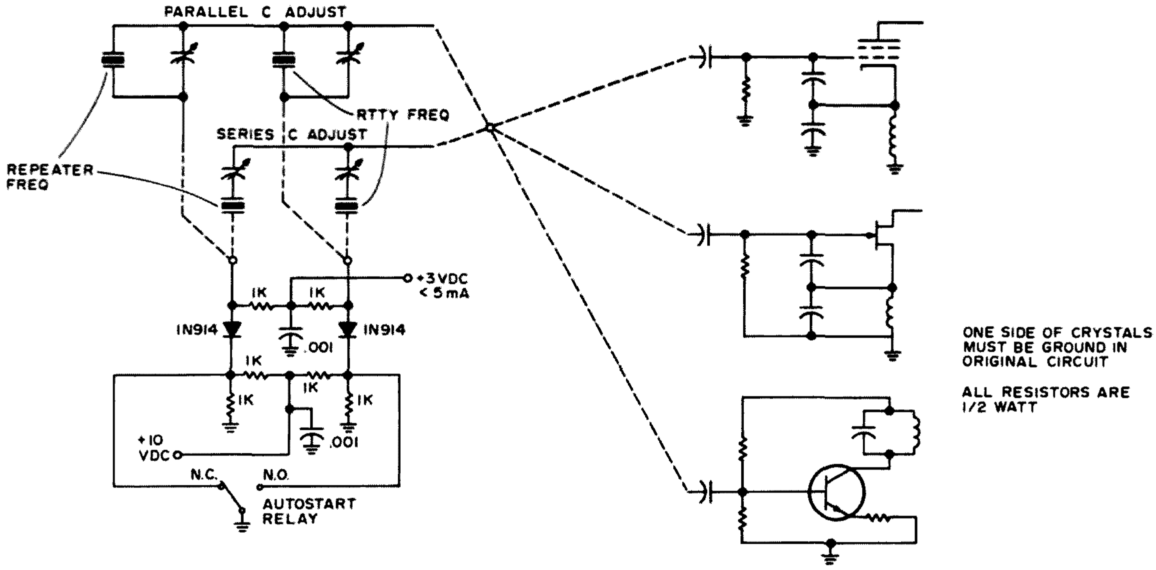

Fig. 3. Diode crystal selection.

This type of switching cannot be used for autoswitch, but the addition of a few diodes and resistors eliminates that problem, as will be discussed later.

I use an RF Communications, Ensign 1, VHF Marine radio which has been converted for use in the 2 meter band. The Ensign has separate transmit and receive oscillators for each channel. The oscillators are gated on by applying a 5V dc signal to the base circuit of the oscillator. Autoswitch merely requires that an unused position on the channel selector switch be brought out along with connections to the repeater channel and RTTY channel positions. The autostart relay in the TU then merely selects the repeater if the printer is off or the RTTY channel if the printer is on. All the delays necessary are already part of the autostart circuitry in the TU. So in this case autoswitch costs three wires! A block diagram/schematic of the lash-up is shown in Fig. 1.

If your rig enables its oscillators by switching an emitter, a source, or a cathode, the connections are equally simple and are essentially the same as in Fig. 1 except that the wiper of the channel switch is connected to ground.

If you own a Regency or some other rig which switches the leads to the crystal directly don't attempt to run the leads out through the autoswitch network and back. You will be adding intolerable lead length to the crystals. Instead, a system for switching the crystals with diode gates must be used. These have been described in other articles describing connection of automatic scanning circuitry to receivers with crystal lead switching.

A method developed by Bob Reifsteck K2LZG for his Regency is shown in Fig. 2. Other methods for other circuits are shown in Fig. 3.

One caution; in any system, always place the channel selector switch in the normal channel (not autoswitch) position when transmitting. If you leave it on autoswitch you're liable to find yourself back on the repeater when you want to be on the RTTY channel if your autoswitch switches off.

Obviously the system is simple. It works extremely well here in Rochester where the number of VHF RTTY stations is reasonable and where the number of messages are low enough to allow all stations to print all traffic. In larger metropolitan areas this simple system might have to be made more sophisticated by using a Touch-tone selective call for the autoswitch to keep the multitudinous printers (which eat gobs of paper) from printing messages not meant for them. When the situation gets that bad here in Rochester we'll go to Touch-Tone autoswitch. Meanwhile, we're happy and everyone is enjoying reading each other's mail.

. . .K2YAH

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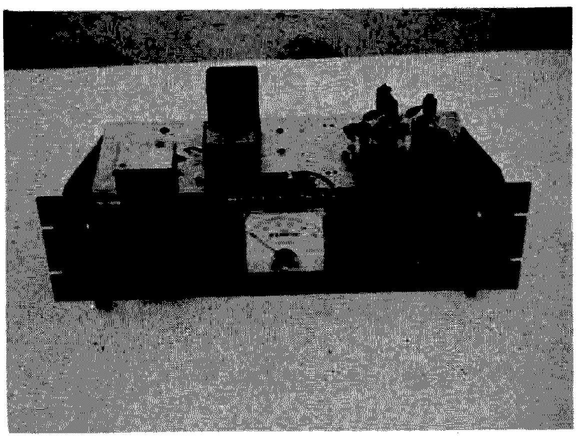
FORTY METER TRANSMITTER

A hybrid design that uses transistors in the low level stages for stability, and easily obtained tubes in the driver and final sections for low cost.

Transistor transmitters are becoming very popular with amateur builders today. The low cost, very high frequency transmitting transistors that are now available make them very popular for portable and mobile rigs. However, the cost and complications of building transmitters of the one hundred watt level with transistors still may be prohibitive for some. Since size, low weight, and low power consumption are not as important in transmitters built for home use, there has been a trend in the past few years to the hybrid concept. In hybrid circuits transistors and tubes are combined to bring out the most desirable characteristics of each.

In this transmitter, transistors are used in the VFO and low level amplifier stages. This makes them ideal for this application because of their low cost (at low power), simplicity (no filaments or screen grids to wire), and low heat dissipation (for stable VFO's). By using tubes in the driver and final amplifier stages, the signal is brought up to the 100W level at junk box cost.

CW was used for simplicity because it is the desired mode at this QTH. AM modula-



Since the transmitter was built from surplus parts, a strange marriage of components results. The old reactive load box chassis makes for a solid and good looking installation, however.

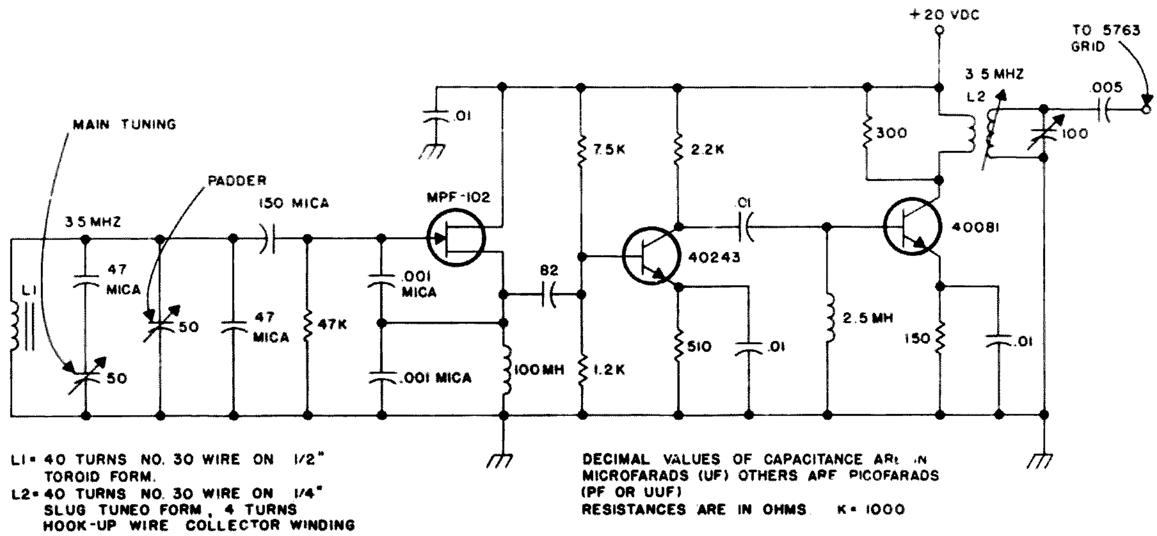


Fig. 1. Schematic of the oscillator and amplifier.

tion was not attempted because of the current unpopularity of this mode on the high frequency bands.

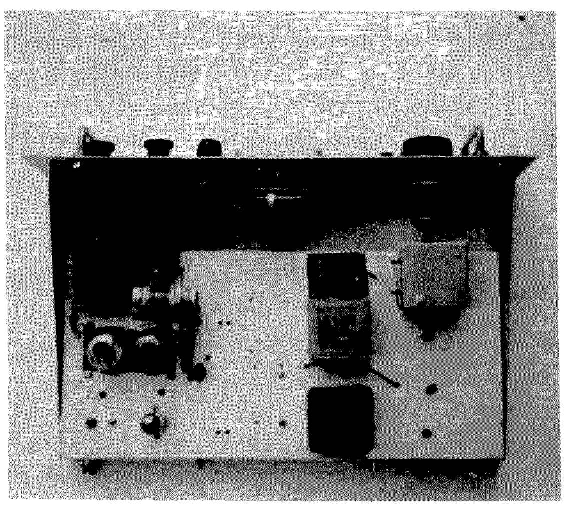
The Oscillator

The Seiler circuit was chosen because of its reliability and excellent stability. The only critical component is the capacitor between the gate of the MPF-102 and the oscillator tank circuit. This capacitor should be just large enough to maintain stable oscillation. The coil used was about forty turns of number 30 wire on an Amidon T-50-2 toroid core. In a different experiment a slug tuned ceramic coil form was used. In this case a gate capacitor on the MPF-102 had to be about 300 pF for stable operation. Either coil resulted in stable operation, but the toroid coil has higher Q, and supposedly better stability. The capacitor values given in the schematic of Fig. 1 give a range of 3.5 to 3.6 MHz. Since this oscillator is so reliable and simple, it is easy to experiment with coil and capacitor values to give different frequency ranges.

The amplifier uses a class A buffer and a class C output amplifier. Some people like to use FET's for buffers, but this was found to be unnecessary. The simple amplifier shown in Fig. 1 was found to be entirely adequate. Almost any high frequency NPN silicon transistor could be used in the amplifier, but the output transistor must be capable of handling a half watt of power or more. A resistor is used across the collector coil of the output transistor to prevent parasitic oscillation and other types of instability. By itself, the VFO would make a fine QRP rig for portable use.

Driver and Final Amplifier

The output stages of the transmitter use conventional tube circuitry, and very little explanation is necessary. The 6146's should be neutralized because they will go into oscillation if drive is reduced. However, there is usually more drive available than is



Top view of the transmitter. The final amplifier with its associated circuitry is to the left and the VFO is at the right. Note the small amount of space taken by the VFO board. With care, the transmitter could be built in a much smaller package.

necessary and instability is no problem. The 5763 need not be neutralized because it is a doubler from the 3.5 MHz oscillator to the 7.0 MHz final amplifiers. The output 6146 stage is cathode keyed while all the other stages run continuously during transmission. The tube portion is shown in Fig. 2.

Power Supply

The power required is 600V or more at 300 mA, and 20V at about 50 mA. The filaments require six volts. The 20V supply should be well regulated for the VFO. In early bench tests a Hewlett-Packard laboratory type power supply was used for the high voltage. This has almost perfect regulation and there was no chirp in the transmitter. However, when a power supply was built, it had poorer regulation. The high voltage output from the homebrew power supply had a 300V drop from no-load to loaded condition, resulting in a slight chirp. No one has ever noticed it, but it becomes more obvious when listening to harmonics of the transmitter. No attempts were made to clear it up, but some voltage regulator tubes in the screens of the driver and finals should help.

The low voltage power supply was a half wave rectifier using a twelve volt filament transformer with the six volt filament voltage connected to the twelve volt side. This gave about fifty volts on the other side of the transformer. The voltage is further dropped by the rectifier diode and the resistance of the filter choke. A twenty volt ten watt zener diode was connected across the output for regulation.

Other than this, the design and construction of the power supplies will not be discussed. There are dozens of articles in magazines and handbooks that tell how to build adequate power supplies.

Construction

Only a brief discussion of the construction will be given. Most hams who would want to build this circuit, or make use of some part of it, will have had enough experience to select and arrange components. The layout and wiring is really not very critical. The main consideration is following a logical step-by-step pattern where one stage follows another so that the output of one stage is not near the input of a previous stage.

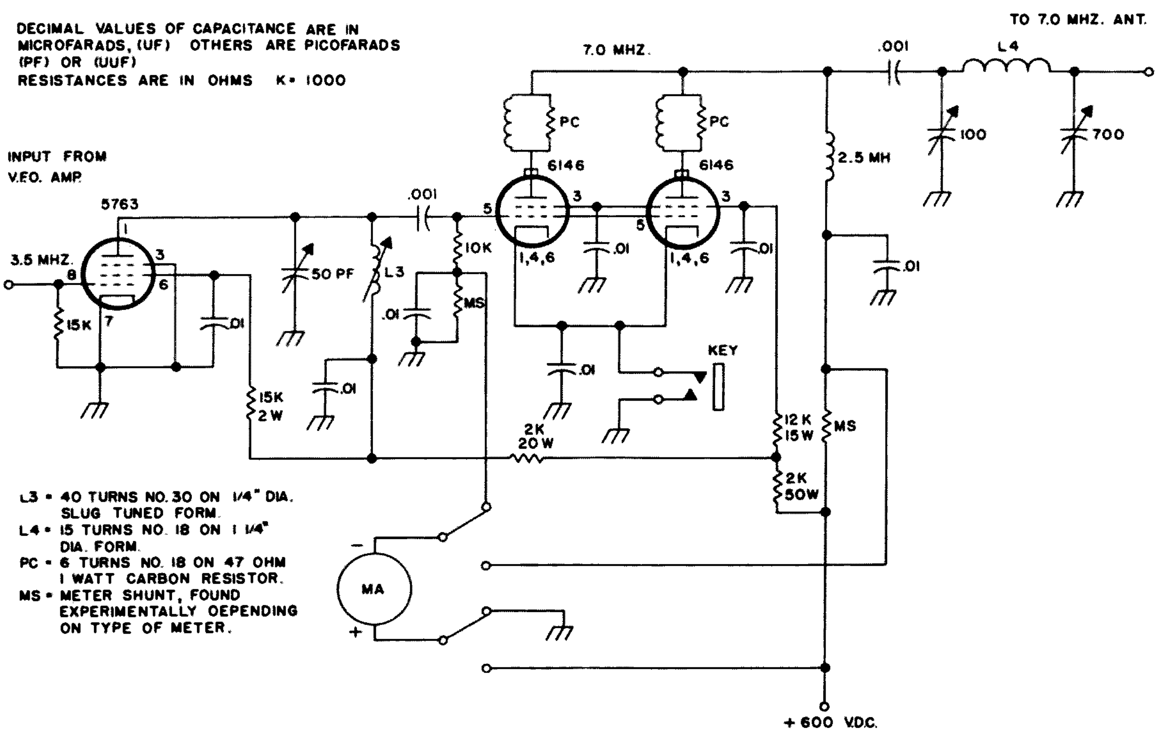


Fig. 2. Driver and final amplifier. This circuit is conventional and is similar to circuits found in many magazines and handbooks.

The 40 meter transmitter mounted in a rack above its power supply. For novice use, just unplug one of the 6146's to reduce the power level below 75 watts.

The oscillator stage is one of the most important. Even though it will not be subject to vibration, it is important to use solid mechanical techniques for the VFO. Since the VFO is not temperature compensated, it should be as far from heat producing components as possible. A small fan was mounted in the cabinet to blow hot air away from the VFO, thus providing excellent stability.

Surplus and junk box components were used entirely, and the layout is really rather sloppy. Excellent performance resulted, however, illustrating the non-critical nature of the circuit. Perhaps some ambitious builder with more time (and money!) will come up with printed circuit boards and a neat cabinet.

Conclusion

This has been a very rewarding project. It illustrates how the transistor and tube can be used together to obtain the best characteristics of both within our present technology. The day of the all tube transmitter is gone forever, and the high power transistors of today tend to "date" even designs like this. Have fun though.

. . .WB6BIH

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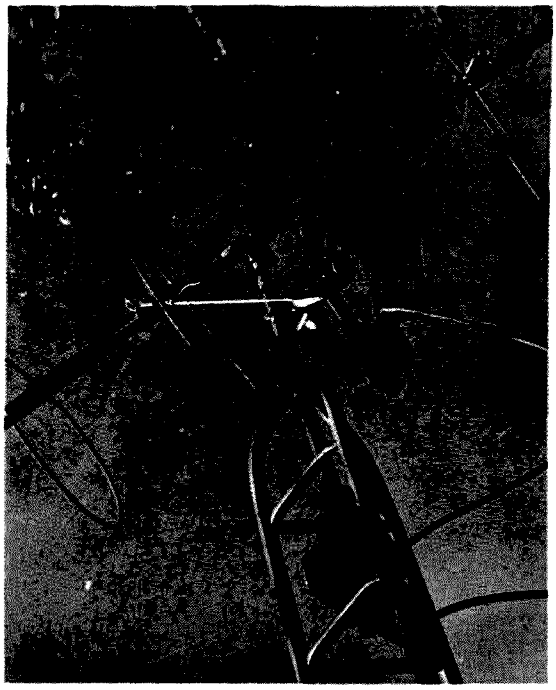
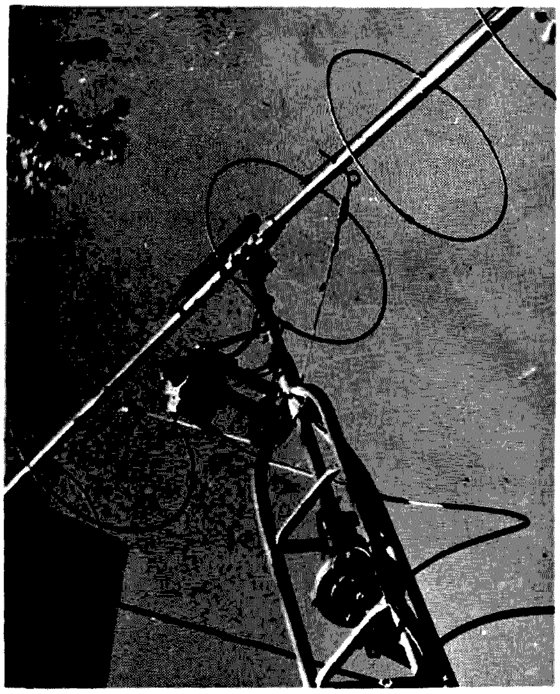
POLAR MOUNT

Attempting moonbounce is a full-time study concerned with azimuth and elevation, moon phases and not-so-amateur communication equipment. Those who succeed are famous, and those who don't make it are ignored. Too many amateurs have been ignored since their attempts were un-proved, or at least un-recorded – but this is wrong, I think, because most of the hardware innovated for this use *is* workable.

I built a moon-tracking antenna about 20 ft in boom length, with questionable success. I heard feeble, chirpy echoes during an aurora. I also had assistance in listening for echoes a few days later when both a good friend and I heard a chirpy twang as we pulsed the moon with irregular dashes. These echoes were not strong enough to be recorded, but there was the characteristic receiving delay of just over 2.5 seconds from the time of key-down; as would be expected! Having un-recorded echoes I felt it would be a good idea to share the experiences I had with inexpensively assembled azimuth and declination rotors and hardware. The antenna is not completely shown on purpose, so that complete details can be reported with recordable echoes at a later date. Many times I've seen articles that supposedly told all, only to be left hanging as to mechanical construction. Here I intend to do a better job.



The most important feature of this view is the pulley wheel. Using an untied system of ropes or cables was not considered because they would have been un-resettable and slip. Two small holes were drilled in the flattened Vee of the pulley for tying. Fastening the pulley to the already shimmed tubing did not hold this wheel without using threaded rod as a set-screw, tightened by a pair of vise-grip pliers, through the hole in the tubing.

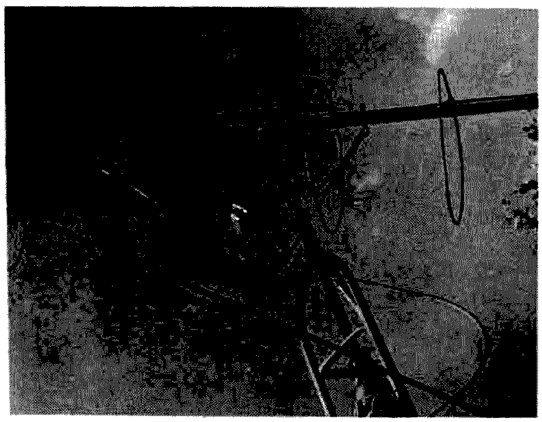


The underside. The most important parts of the mount are: First, front and rear Toro drawbar springs; Second, the Alliance C-225 rotor mount; Third, aluminum strap bracing from the C-225 body-to-mast; Fourth, the WB-3 house bracket fastened to rotating mast (above the nylon bearing); And fifth, the swivel top rotating boom plate, cut from a Dill tilt-over tower footing.

Theory

Not being more than average, mechanically, I cannot always use the most exact terms to describe my efforts; but as an amateur I can point out the approach. Most AZ-EL mounts usually refer to 360° azimuth and 90° elevation rotor systems, using crossed masts and bell-type rotors positioned in some sort of box. This is fine for those who can afford it! However, I used every short cut possible. I rotated the declination rotor on the "azimuth mast" and then I tilted the whole tower on a Pickle base. The Pickle base is a 4 ft section of tower with movable lugs and welded sheet metal, sunk 3½ ft into sandy soil – instead of concrete. One secret which should be passed on is the use of a nylon bearing in the top-section which supports the mast. Without the bearing (see photo) it would be impossible to swing the array in any direction desired because of mechanical drag. An underside view shows two draw-bar springs which take up slack and allow for 180° control-box indication on the declination rotor.

Only 50° of declination rotor control is necessary within the 180° available. That is,



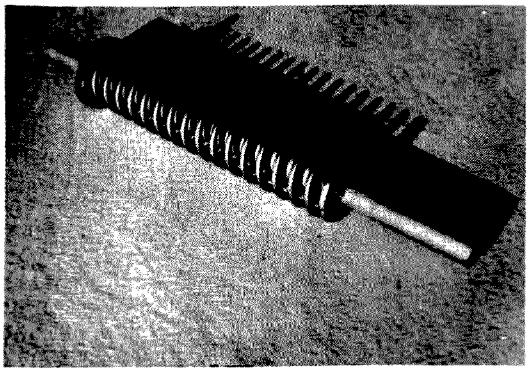
This shows the side view of the mount and the telescope. The telescope is made from a piece of 1½ in. OD aluminum thinwall. It is painted with high-heat flat-back auto paint to minimize internal reflections. A plus 3 diopter closeup lens is used for the optics. This lens is mounted in a series 5 adapter ring, taped to the tubing. An RCA cadmium sulfo-selenide photoconductive cell is mounted inside. We also used a teflon disc inside the tubing, with Loc-Tite epoxy, for cell mounting. Black silicone rubber is used as the encapsulent. The aluminum thinwall is 13 in. long.

This photo shows bracing of the leaning tower. Correct aiming toward the north is most accurately done by incling the structure toward the North Star. In my case, an rdinary pocket compass was adequate since there is only 1° difference between true north and magnetic north. The actual tilt angle is 52° relative to a flat horizon; earlier we said that 90 minus your northern latitude: so, 90 minus 38° is the tilt angle used here.

minimum boom-swing is conveniently limited to plus and minus 25° about a right angle subtended on the tilted mast for an arc across the sky. The rotor indication of 180° is well in excess of this. Moon wobble is caused by the varying orbit of the moon on a day-to-day basis, but the average value of the wobbles is always from east to west across the sky. To follow this arc exactly, it is necessary to incline the tower by 90 minus your north latitude in degrees.

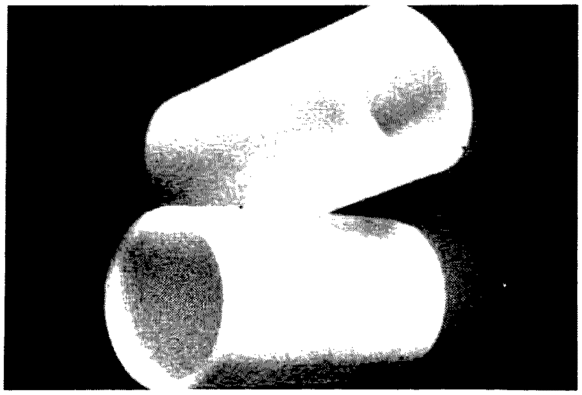
Construction

Most of the mechanical parts secured to



The rotary torsion bar. Although this idea is that of K8ZEU, it works equally well for moonbounce or regular hamming! This device allows a "give" to rotational torque encountered when starting or stopping a large antenna. The welded plumber's pipe used is internally overlapped to strengthen the mast About 1 in. clearance exists between the overlapped end and the "washer" below.

the boom are attached with South River WB-3 aluminum house brackets. Hy-Gear screw-straps are used elsewhere (for bracing and for the telescope mount). The swivel-top boom plate was cut from a Dill lift-up roof mount and drilled for 2 WB-3's. The drawbar springs are available as Toro lawnmower parts and should be easily found. They connect the threaded nylon fishline to the boom and declination pulley. Slippage is prevented by connecting the line through the flattened Vee of the pulley; then pulled through 3/16 in. steel washers and knotted.



A close-up view of 2 type 101 nylon bearings. The nylon rod is chosen to have a diameter which will fit (by press-fitting) the inside of the tower mount. Prior to this, the nylon rod stock is chucked in a lathe and a 1¼ in. hole is cut lengthwise. The two sleeve bearings shown here are 3 in. long; however, they're drilled 1½ in. for other tower mast size. After the original 1¼ in. piece was drilled it was hammered into the mount, making a forced-fit.

The AR-22R rotor is located on a predrilled mounting tab inside the top section. Top and bottom bells are drilled and have 5/16 in. steel bolts through the mast. Gear slop with this rotor is 6°, which is not exceeded by this method of fastening. The C-225 rotor has only 3½° slop, however; so it was chosen for declination positioning. Bolt threads are treated with Loc-Tite Nut Lock to prevent loosening. The Browning pulley was successfully shimmed using lengthwise cut aluminum thin-wall tubing.

To those who will try moonbounce, let them experiment with this method and take some of these short-cuts. Maybe this article will help solve some problems! Anyway, E.M.E. will be more in style now with special emphasis placed on communications-through-repeater from the moon.

. . .W4KAE

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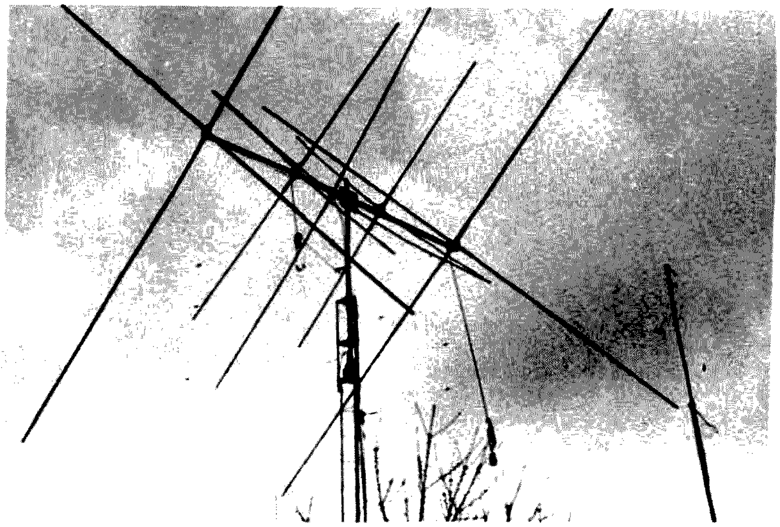
URBAN QUAD



The merits of the cubical quad have already been established, its inherent weaknesses noted and suitably assessed against its formidable strengths, and a myriad of articles published describing various configurations, including one rather unusual array describing the 3-4-6 quad which appeared in this hallowed journal in November, 1971.

The quad pictured is a good all-around antenna for the urban dweller who has limited space and wants something better than the typical commercial triband Yagi, and something cheaper! Clearly it is not an isotropic source and requires some room, but no more than the triband Yagi – less, in fact. It consists of 4 elements on 10m, 3 on 15m and 2 elements on 20m. The spacing is a bit wide on 20m, but there is significant front-to-back and forward gain and a broadbandedness that comes in handy when shifting from low end CW to high end SSB. The spacing on the other bands is somewhat closer to optimal for forward gain, and the array performs most impressively on all bands at a height of only 10.5 meters. The boom is 460 cm long.

In general, the longer the boom length of a directive array – whether Yagi or quad – the higher the forward gain. The unique character of the quad is that for a given required gain it need be only about 0.56 as long as its Yagi counterpart.* Thus, this described quad should approximately equal in performance a Yagi with a boom length of approximately 800 cm. Sounds familiar? Look at the boom length of the larger triband Yagis currently advertised. The question, of course, is whether this antenna does as well.

The following figures are arithmetic averages of a number of tests made with local hams; they do not reflect the low angle of radiation proffered by the quad, nor variations in height or environment. They only suggest that this antenna is at worst in the same league as those *larger* triband Yagis and at best is better. It is significantly better than the *typical* triband Yagi.

**By virtue of vertical lobe compression*

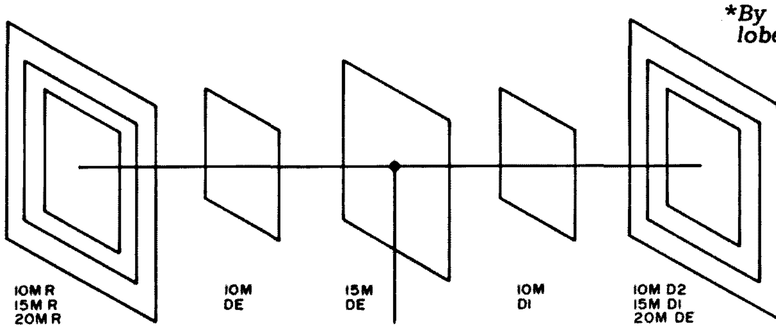


Fig. 1. The Urban Quad.

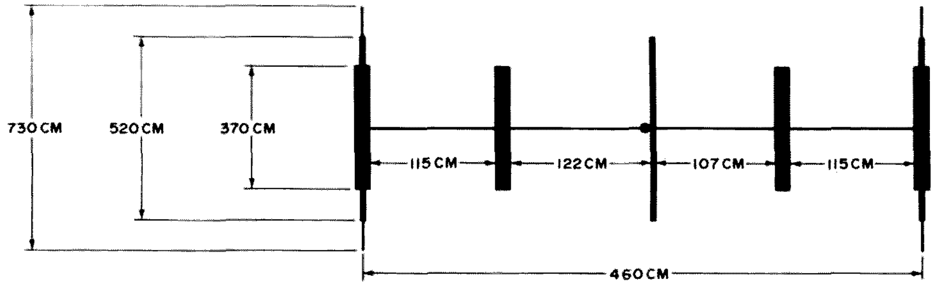


Fig. 2. Element spacing.

Front to	10m	15m	20m
side:	45 dB	34 dB	23 dB
back:	26 dB	23 dB	19 dB

There was no convenient way to make forward gain measurements, and indeed a fraction of a dB one way or the other is insignificant and will even vary to some extent as a function of height, tuning, etc. The point is that this antenna, with only 2 elements on 20m and a 460 cm boom is performing well!

Parts and Cost

Improvements may be made on the following figures by using scrap supplies or other materials, but compare the cost with a Yagi of similar characteristics.

Bamboo poles (12-460 cm long;
8-24 cm long) $15
Clamps with stainless screws, #14 wire . . . 25
460 cm boom: 5 cm OD, 1/8" wall 15
Aluminum plates for spreader-boom
mounting (from junk yard) 6
Coax, RG8/U (3-23m rolls)
3 baluns
Length of quarter wave transformer,
RG9/U
Total (plus cables) $61

The array has withstood 64 knot winds and Hurricane Agnes with no damage save a broken wire at the balun-to-loop tie point of the 20m driven element (which could have been avoided had #14 wire been used instead of #16). Number 14 has been specified in the list. At this QTH a fair amount of antenna experimentation is done, so bamboo is practical; but fiberglass arms would probably be a more suitable material since the antenna will likely be up for quite some time! However, the bamboo in this array has been in quad antennas for four years now and has only recently begun to show signs of weathering.

Tuning

Regarding tuning, the spreader assemblies are constructed on the ground and cut to approximate dimensions, preferably a few cm shorter than that required. After mounting them on the boom and hoisting it all off the ground, tuning is accomplished using a grid dip meter, and wire added at the stub tie points as required for ±5% tuning on 15m and 10m, and -3% center frequency resonance for the 20m reflector (longer), since that band already is somewhat broad by virtue of wide spacing and a bit tighter coupling is necessary to lower the impedance and achieve lower vswr. In addition, a quarter wave matching transformer (RG9/U) was used between the balun and the feedline on 20m, though the need for this may depend on tuning. The vswr curves will tell you whether you need the transformer. The wide spacing is worth the return of improved performance on 15 and 10. 20m does not seem to suffer from wide spacing.

Performance

The other day on 15m SSB, half the east coast was calling EA9EJ (I heard them back-scatter, thanks to the low angle of radiation!) and K3MNJ worked him first call. (Should I also mention that I called in Spanish?) No, the antenna is not in the K3JH class, but it does well against those triband Yagis and is relatively compact and inexpensive. For those in urban centers, it may be just the thing.

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LOGIC AND REFLECTED POWER

Something you'll understand if and only if you read this article.

Reflected power in mal-terminated transmission lines has triggered more discussion, argumentation, and even anxiety than almost any subject since the famous power factor debates of the early 1920's. Some of the anxieties and worries engendered by overconcern about possible ill effects to equipment or excessive loss of transmitted power can be relieved by the application of logical reasoning. And that application of logic is the purpose of this article.

Let's start with an antenna – an antenna so constructed that its feedpoint impedance is 12.8Ω. It doesn't matter too much if that impedance is composed wholly of resistance or of an admixture of reactance and resistance. In either case, it offers a 4:1 impedance mismatch to a 52Ω transmission line.

In order to effect a match between the line and the antenna, we put an impedance transforming device between the two. This may be one of many different forms; you can call it a Matchbox, a Transmatch, or any other term. In each instance its function is to transform that 12.8Ω impedance to a resistance of 52Ω.

When such a transform has been accomplished, the transmission line is matched to its load, there are no standing waves on the line, and the transmitter feeding it is "happy." This is the condition you want to attain and maintain.

There is no compelling reason that the impedance matching device must be located at the junction of the line and the antenna. Suppose you place it down 10 feet from the junction. Then the line from the device to the transmitter retains its matched condition and the transmitter still is happy. But what about that 10-foot stretch of line between the device and the antenna? Won't there be reflected power coming back from the antenna because of the 4:1 VSWR? And won't

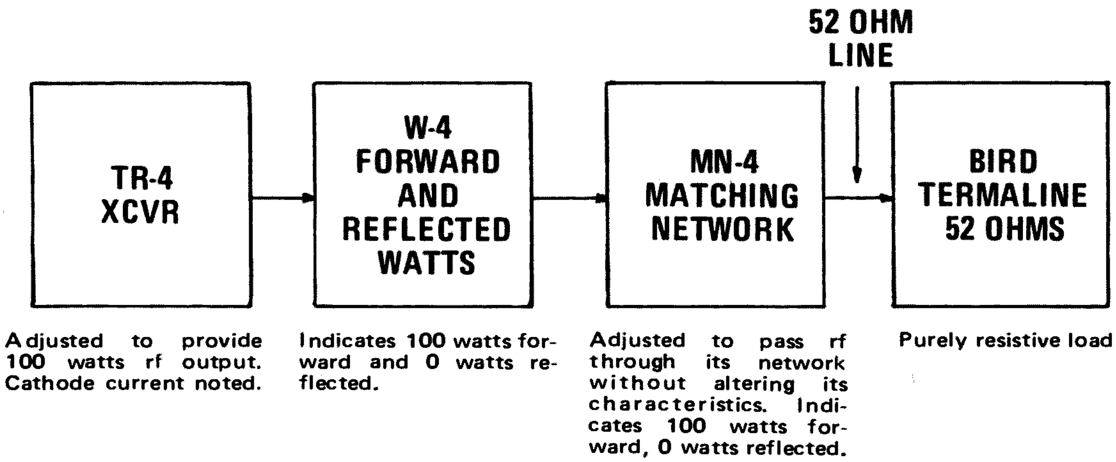

Fig. 1. Properly matched transmitter (running 100 watts output) indicates 100 watts forward and 0 watts reflected on the wattmeter.

that reflected power be lost, be deleted from that available for radiation from the antenna?

Yes, there'll be reflected power in the 10-foot section of line, and this will result in a 4:1 VSWR on that section. But no, there will be no appreciable power deleted from that available for radiation from the antenna.

Let's consider why. In the first instance, when the impedance matching occurred right at the antenna/feedline junction, any reactive element of the antenna feedpoint impedance was negated by a conjugate reactance presented by the matching device. Then the remaining element, purely resistive, was transformed by the matching device to 52Ω. The same situation prevails in the second instance, too. However, the magnitudes of resistance and reactance, and even the sign (+ or -) of the reactance may be changed, especially so if that 10-foot length represented any appreciable fraction of a wavelength, as it would on 6 meters or even 10 meters. But the situation of reflected power remains unchanged; it existed at 0 foot, would exist at 0.25 foot, and exists at 10 feet. In each of these situations the only actual loss of power is that dissipated in the form of heat.

With a VSWR of 4:1, the peak magnitude of voltage present on a transmission line will be four times that which it would be if the line were "flat." The peak value of current also will be four times as high. There will be definite points of high voltage and definite points of high current. Each high voltage point is a half-wave removed from another,

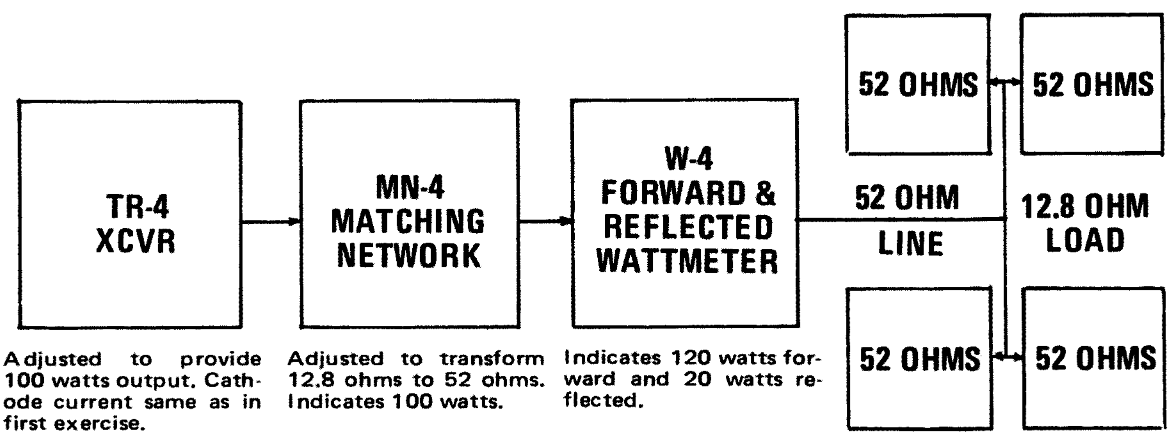

Fig. 2. Improperly matched transmitter (still running 100 watts) indicates 120 watts forward and 20 watts reflected. 100 = 140?

and each high current point is a half-wave removed from another. Each of these high (voltage or current) points occurs at a spot on the transmission line where the line appears as purely resistive. At the high voltage points there will be dielectric losses in proportion to E^2/R, and at the high current points copper losses represented by I^2R. These losses are in addition to those normal losses present in a transmission line, even when the line is "flat." The energy consumed by such losses is dissipated in the form of heat.

But what about reflected "power?" Note that "power" is placed in quotation marks, indicating doubt as to its reality. Can one use logic, logic based upon a demonstrated and reproducible illustration to ascertain whether the "power" is real or illusionary? Yes. Very easily and simply.

Here is what I did: I used a Drake TR-4, a Drake MN-4 matching network, a Drake W-4 forward and reflected power meter, and four Bird Termaline 52Ω dummy loads. See Figs. 1 and 2 for how they were connected.

Using one 52Ω load initially, with the W-4 between the TR-4 and the MN-4, the TR-4 was tuned and loaded to display 100 watts output into the dummy load. This value of power was confirmed both by the W-4 and the MN-4 after the latter was properly adjusted. Then the TR-4 was connected directly to the MN-4, and the W-4 was moved to between the MN-4 and a new terminal load. This load was constituted by four Termaline loads connected in parallel by means of "T" connectors and very short lengths of 52Ω RG-8/U cable. This combination presented a load of 12.8Ω and was purely resistive. With such a load, the VSWR was 4:1. Next, the MN-4 was readjusted to present a 52Ω load to the TR-4, which was still generating 100 watts of rf power, as verified by the wattmeter function of the MN-4. But what about the forward power and the reflected power as shown by the W-4? In the forward position, it indicated 120 watts; in the reflected position, it indicated 20 watts!

Now one sits back and exercises a bit of logical thinking. You know quite well that there was no supplementary power-generating device introduced into the circuit. The 100 watts produced by the TR-4 is the sole source of rf power in the circuit. Unless there's "black magic" concerned, that extra 20 watts of power surely must be illusionary! Then there's that coincidence of the inexplicable 20 watts of not-generated-by-the-transmitter power being exactly matched by 20 watts of reflected power!

It doesn't require much application of logic to come to a valid conclusion: The extra 20 watts of forward power and the 20 watts of reflected power cannot be true power.

This so-called power is represented by standing waves on the feed line. A quick inspection of the points of minimum current and minimum voltage (these are more easily located than the points of maximum current and maximum voltage) shows that they are 90 electrical degrees apart. A quick reference to alternating current theory shows that power is equal to current times voltage times the cosine of the angle between the first two. Another quick reference, this time to a table of cosines, shows that the cosine of 90° is zero. And, of course, any number multiplied by zero is zero.

Therefore your application of logic has demonstrated that reflected "power" is a fiction, a vicious fiction that has caused many radio amateurs much worry and concern.

The knowledge of reflected "power" being truly a figment of nomenclature should not be taken as proof of a low VSWR being of no worth. Under certain circumstances, it can be sorely needed. But when your transmitter will load normally into your transmission line, there is no need for you to be concerned over a VSWR of 5:1, certainly not one of 4:1. If your transmission line is less than several wavelengths long at the frequency you're using, the amount of power that you'll lose as heat along the transmission line will be quite negligible. But if your transmitter doesn't load happily into your line, then you need some sort of an impedance matching device between your transmitter and your line. It won't increase the amount of rf power your antenna will radiate, but it will make your transmitter happy!

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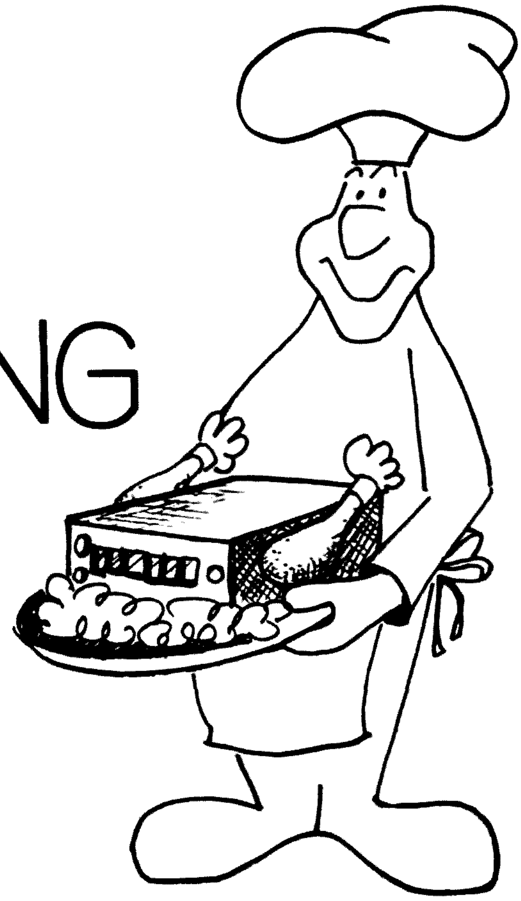
RECIPE FOR GARNISHING A COUNTER



My compliments to the chef! The chef in this case being Mr. Peter Stark K2OAW. His article in the May, July and September 1972 issues of *73 Magazine* has presented ham radio with a top grade piece of test equipment right when we need it. Amateurs should be building at least their own test equipment, and the prices and availability of the required parts are at their best. For almost the price of a good VTVM kit, you too can own a commercial quality counter.

While this is a construction article, let me say that Mr. Stark's counter worked perfectly the first time without any of my additions. This says a lot for the three-part layout, good board design, and a lot of hard work on his part. The additions I am going to suggest for his circuit are, as my title implies, gilding an otherwise already fine lily! I will present the additions so that any one or all of them can be made, since each change is complete in itself.

Accuracy

This is the name of the game when dealing with frequency counters. International Crystal was quick to fix me up with a good crystal by only sending them a schematic of the circuit and Mr. Stark's suggestions on this item. I purchased a 10.00000 MHz crystal for $9.50 in holder HA 505. It fits the pins removed from a 9-pin miniature socket and soldered into the board at the proper spacing. I like plug in crystals for ease in changing and do not like to heat up an accurate crystal. Also, if you later use an oven of the right temperature this one could plug right in. This should solve the one part that may be hard to find in some areas. They will air mail the crystal well protected against shipping hazards. The accuracy of my crystal is .0005% (specify a high accuracy crystal when ordering). They are listed under Medium Frequency Crystals in the catalog.

Further on the subject of accuracy, several good articles have appeared recently on WWV converters and receivers (*73 Magazine*, November '72, page 59, WA8OIK , for example). If you allow enough room in your enclosure it is worthwhile to build one into the counter. Depending on your WWV reception it can be designed for 5.0 or 10.0 MHz, since you have both frequencies coming off the timebase divider chain of IC's. I chose a small solid state AM radio available from many of *73*'s advertisers for $5 to $10, and put it into a small aluminum enclosure with an International Crystal SAX-1 (lo kit) rf amplifier, MXX-1 (lo kit) mixer, SAX-1 (lo kit) i-f amplifier-buffer, and OX oscillator (lo kit) running at 10.7 MHz for an instant converter to 700 kHz on the broadcast band. If you like this combination as well as I do, you can always build a duplicate for mobile use. Choose a quiet spot on the AM band for your own particular i-f frequency. Order the EX type crystal for the oscillator module by either adding or subtracting the i-f frequency from 10 MHz or 5 MHz, depending on the WWV signal desired. In this area (central Indiana) a small collapsible CB handi-talkie replacement whip on the cabinet is enough, but a BNC fitting also feeds the rf module just in case.

A Case for Your Better Mousetrap

While aluminum boxes are being discussed, the enclosure you choose adds both to the looks and its versatility. Since my station is all Drake, with homebrew accessory items built into Drake enclosures, it was a natural that I chose that type of enclosure for the counter. An R.L. Drake TR-6 cabinet was ordered with black finish, for approximately $16 postpaid. A panel was punched out of .06 aluminum. I used a 10x12x3" aluminum chassis (common size) for the mainframe. Cut out the front (10x3) to clear the hardware mounted to the front panel, but leave six places for 6-32 screws to mount the panel. A cutout is made in the top of the mainframe (10x12 surface) the same size as the outer copper dimensions of the K2OAW circuit board, leaving a 10x5 area for a 10x5x2 box above the mainframe in which to mount the converter-radio, and a 10x5 area below the mainframe on which to mount the transformers, power supply board, etc Using the large enclosure yields more space for other modifications.

Hi-Lo Circuits

I used separate BNC fittings to feed the Hi and Lo inputs to allow quick switching between two points in most FM gear, etc. By making the Hi-Lo input switch a DPDT unit, one half can be used as the original SPST, and the other half is wired to two small low drain 6V panel mount bulbs from Southwest Technical Products (in your choice of colors). I mounted these bulbs above their respective BNC connectors to tell at a glance which input was being monitored.

Test Count and Timebase

As can be seen in Fig. 1, one other change is made to add a feature found on the more expensive counters available. You can indirectly read the 10.0 MHz crystal timebase clock generator to determine it is running accurately by adding a SPST momentary pushbutton switch to the front panel below and between the Hi-Lo lamps. A wire is run close to the board from IC-26 pin 14 to one side of the switch, and from IC-4 pins 6 or 9 to the other side of the switch. Keep the leads close to the board, as the timebase chain runs 1.2V to 4.2V squarewaves and that makes an rf generator rich in harmonics if long unshielded leads are not dressed carefully. Momentarily pushing this switch will light 10000 on the readout if the timebase switch is in Hz or 00010 if in kHz position. A nice fast check on all being well

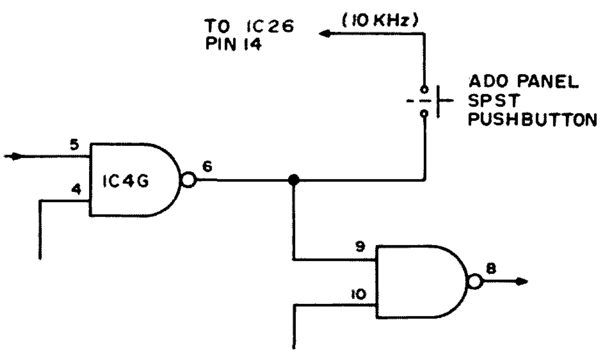


Fig. 1 (modified Fig. 5 of the original K2OAW Counter article). Test count modification. Pushing switch will cause the counter to read the frequency of the 10 kHz time base to determine proper operation.

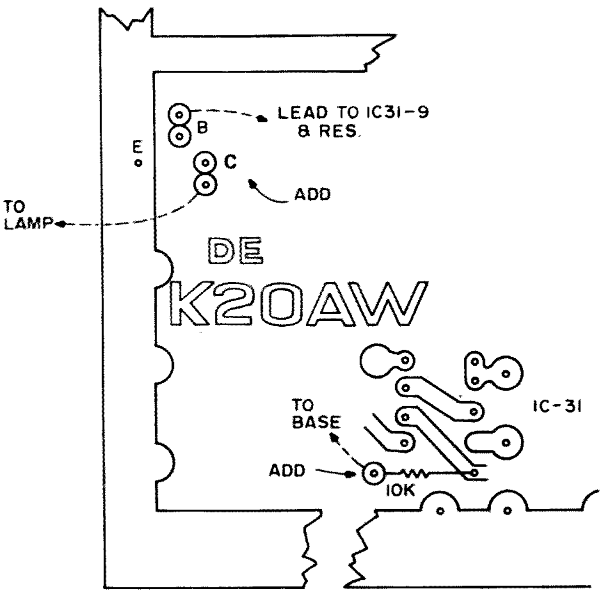


Fig. 2 (modified Fig. 23). Modification of the PC board to incorporate the extra circuitry in Fig. 3.

in that territory, both after building and in the future.

While in the timebase circuit, run a 10K ½W resistor from IC-29 pin 11 (1 Hz) to a nearby open area (no copper pads) and solder a lead from this resistor to a like open area around the large filter capacitor at the rear corner of the board. (See modified layout, Fig. 2.) Drill five small (#60) holes per the new layout to mount a transistor to be wired as in Fig. 3. The hole on the edge of the board is ground for the transistor emitter. The remaining holes accept the base and the wire from the 10K resistor. Run the wire through the board from the top (component side) and fold it and the transistor

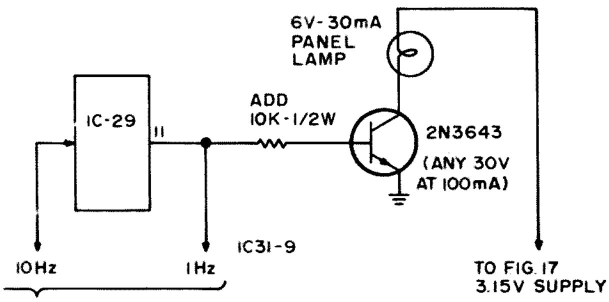


Fig. 3 (modified Fig. 8). The addition of a transistor, a lamp and a resistor adds a visual indication of the operating timebase.

base lead to meet one another and solder. This forms your own "pad" as there is no copper here. The last two holes are for the collector and one lead of another Southwest Technical Products panel lamp mounted below the over-range lamp. The remaining lead of this new lamp goes to the 3.16V Numitron supply as did the added Hi-Lo lamp source leads. The lamp blinks on and off one time per second giving a reassuring blink to let you know all is alive and well in the timebase circuit. It doesn't check the gating controls, but it tells you a crystal and 8 of 33 IC's are running o.k. Even if you don't build in the WWV circuits, it would be wise to put this one in.

Timebase – The Hard Way

By putting in the 1 Hz lamp you can even calibrate the counter to a reasonable degree if you are patient enough. It's not a super accurate means, but it beats no way at all. Count the blinks for exactly 3-5 minutes and compare with the number of seconds in the time period you use (180 blinks for 3 minute period, etc.). Obviously you should use an electric chronometer with smooth sweep second hand as your "standard," and this "formula" should be modified for non 60 cycle mains areas. Compare your "clock" blinks to the standard used and correct your trimmer capacitor to make your clock faster (more blinks) or slower. Power companies maintain 60 CPS ±1 Hz for line frequency, and most keep their short term accuracy even closer since the National Grid System was started. This way your standard clock can give you a very accurate 3 or 5 minute period to use. Give this method a try in your area whether you use the WWV method or not and let me know your results. I know we were somewhat amazed how close one can get with patience. We have gotten to within 10 Hz on the 10 MHz crystal.

Readout Check

This is another item "borrowed" from more expensive counters at the cost of a SPST pushbutton switch. If you are not well acquainted with the ICs used in the project as I am by my employment, you could overlook this addition that is already in-

cluded in the ICs. By carefully connecting all of the pin 3's of the SN7446 or SN7447 readout drivers (whichever you use) together, and then to one side of the SPST switch mentioned, and then connect the other side of the switch to ground, you have a readout check. Mount the switch on the back apron, as it is not used often. Pushing the button briefly (easy on the power supply, fellas!) will light all the readouts with the number "8" (all segments lit). This allows check for filament burnout on Numitrons, open wiring during construction, etc.

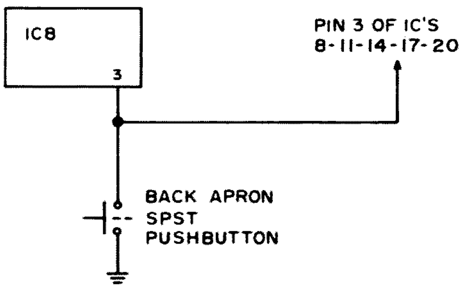


Fig. 4 (modified Fig. 6). Readout check. Pressing the pushbutton causes all segments of the readouts to light.

Burnout Protection

The ECL IC logic being somewhat expensive, you may want to use the same protection used by K2OAW in the June 1972 *73 Magazine* article featuring his 300 MHz frequency scaler. While in the counter he uses an extra amplifier ahead of the somewhat "touchy" IC 2, it still is comforting to have the added protection of the old criss-cross diodes trick of the receiver/converter days. Use 1N914 diodes just as he did in the June article. See Fig. 5.

Accuracy – Accuracy

In the section under accuracy I mentioned the clocking method, but don't get the idea I either prefer it or enjoy the long "blinking" count (pardon the British pun, it's my English ancestry). I have for some time now used a very inexpensive zero-beat method that tops all I have tried. I have used it to zero commercial, amateur, and test gear, and just wasn't aware it wasn't as well known as

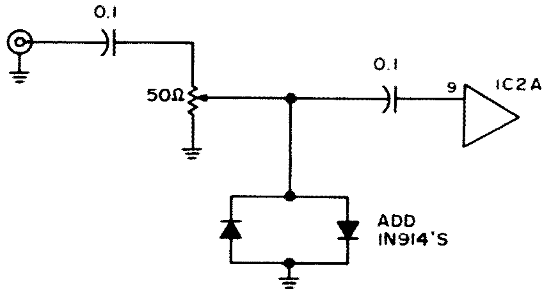


Fig. 5 (modified Fig. 4). The addition of back to back 1N914's adds burnout protection to the front end.

I thought. (See Fig. 6, added). I mounted a speaker in the lid of my TR-6 enclosure since it is already perforated for heat. A shielded cable (RG-174 type, etc.) is used to route it to the back apron of the mainframe. One other small module is added to the converter compartment, namely Fig. 6. Audio is tapped off the speaker lead and fed to the zero-beat detector. Normal leakage or a small lead is used from IC 22 pin 8 to the input rf Sax-1 module to couple a small amount of 10.0 MHz rf from the timebase to the converter. Turn up the volume on the BC radio and tune in WWV by rocking the BC tuning capacitor around the i-f frequency you have chosen. With the counter turned on you should have a nice clear beat note if coupling is correct. Trim this note down as close to zero CPS as you can by adjusting (slowly!) the counter's trimmer capacitor. This will put you within 15 to 20 cycles if you have reasonably good hearing ability. Now, the fact the ear is a good detector from 40 to 15,000 CPS, and the eye is only good for pulsations of zero to 40 CPS, leads you to conclude that when you are at 15–20 CPS and trying for zero it is time to change detectors! By using the circuit shown in Fig. A, you can now see the 15–20 CPS, and by slowly trimming the counter trimmer you can hit fairly near zero. Remember that we are referring to "per second." If you carefully do your job, one cycle per ten seconds is not hard to come by. Where's that steady hand and patience?

To get my crystal to "zero" first I used a 14 pF NPO fixed capacitor in place of the 33 pF in parallel with the trimmer. Next, a piston trimmer 1 to 5 pF is added in parellel with the trimmer as a "fine" adjust. Make a

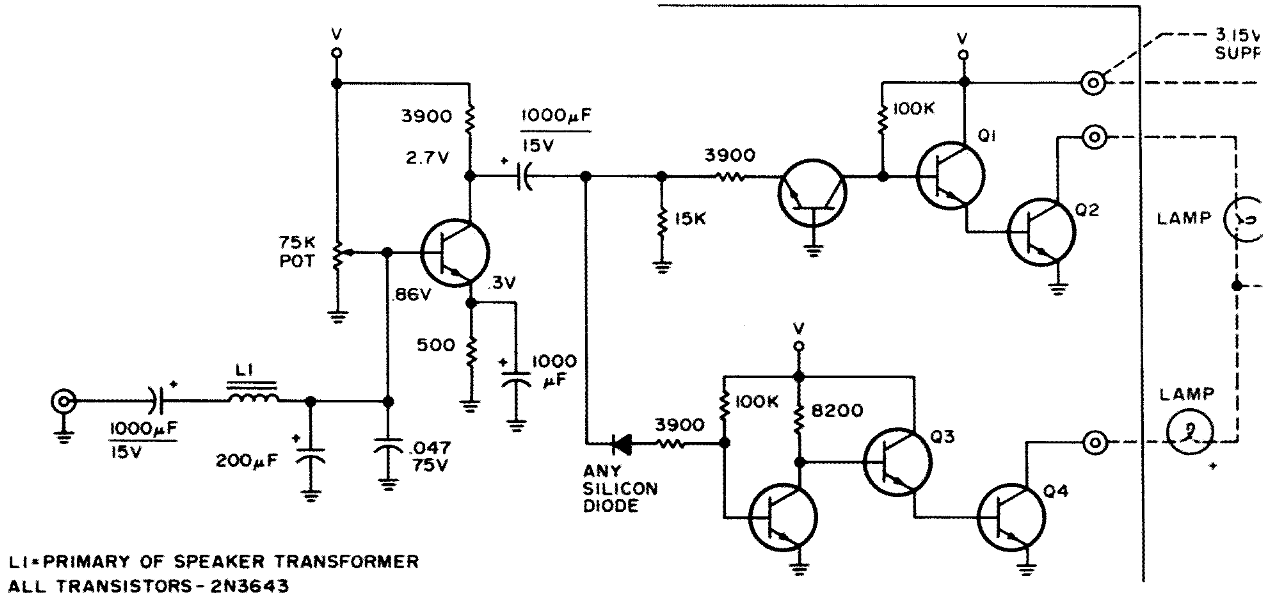


Fig. 6. Schematic of the added zero beat indicator. It can be assembled on a small PC board and mounted in the converter compartment.

small 5-sided cube to cover the crystal out of thin styrofoam packing material using airplane cement or rubber cement to put it together and attach it to the board. The crystal will still run at room ambient, but small air currents won't cause "eddy drifting." From there on, it's only the patience you put into it.

Any further help I can render, please send SASE and your questions worded as best you can. Fortunately I work in a design job requiring my knowledge of this type TTL ICs daily, so I might be able to clear up problems arising from not knowing what makes TTL tick. I must say K2OAW gave an excellent rundown on the use, care and feeding of TTL in the three articles. If you are planning any TTL project I wholeheartedly recommend reading them to keep out of trouble. Time and time again in my job I find TTL has more intelligent logic control than you or I. By this I mean almost without fail it does exactly what it is commanded to do. In three years of working with them I have found only one IC defective from the vendor using over-the-counter commercial grade (not mil-spec) devices. If you choose to save quite a bit by going through one of the many *73 Magazine* advertisers listing TTL devices, I can only speak from my own experience with the three I have tried to date. They have been excellent in quality and service, not to mention price. Incidentally, one of those sources yielded an SN 7473 that counts (divides) to a reliable 36 MHz. This means my basic low frequency part of the counter goes to 36 MHz. Use your best SN 7473 (highest divide frequency) for IC-5. By all means try switching IC-5 and IC-21, since high speed in IC-21 doesn't buy you anything anyway.

Only one comment should be added. The plus 5 volts can be 4.75 to 5.25V dc according to the manufacturer's data and you can still expect proper operation. Use a *stiff* and well regulated supply set to 4.9 to 5.0V dc. Do not try running at over 5.1V dc for any reason, as you are killing any margin of safety you have. At 4.75V dc and down the ICs fail to operate, but at 5.25V dc and above the ICs may and usually do fail permanently. With 33 of them to worry about, the expense of a good supply is small. Several good "Crowbar" circuits have appeared to shut things down in the event of too much current or voltage and I recommend the use of one of them. Also, as K2OAW suggests, put in only one or a few ICs at a time and get sections of the counter going, rather than trying the "in one crunch" method.

Have fun, and more important, thanks to Mr. Peter Stark, who has designed it, have a fine test instrument for a very reasonable fee.

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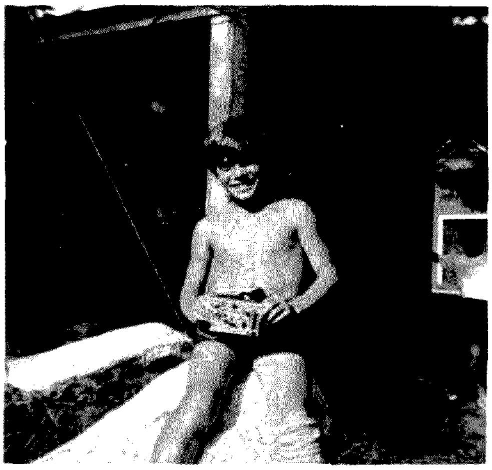
THE HAM'S PERFECT SUMMER JOB?

Like to get away from the city for a summer, to another part of the country, perhaps? Imagine yourself operating your rig under fragrant pines on the edge of a crystal-clear lake in southern Maine. That was my experience a couple of years ago, and it can be yours if you would enjoy teaching amateur radio at one of the numerous private camps located throughout the U.S.

Camp directors are rapidly discovering that it pays to offer more to campers than standard athletic fare. With the boom of technology, parents are anxious to see their offspring getting into the act. And what is a more practical beginning than amateur radio?

Getting in touch with these camps is your first objective. If you're a student, college placement services can generally get you information. Many camps circulate their literature throughout U.S. campuses. The American Camping Association can give you assistance in getting a radio position, and ACA standards assure you of a reputable outfit.

Most private camps operate on an eight-week summer and begin recruiting staff early in the spring. When interviewed for a radio counselor position, there are several important points to note. First of all, camps will generally require counselors to be at least 18 years of age, and most directors prefer staff over 21. Depending on how you present yourself, it's not too difficult for a director to forget the usual age preferences. Naturally you should have at least a General class ticket with a few years background in the technical end of the hobby.



Young camper with two transistor radio he built during the summer course.

Directors are also concerned about how well you can organize and – most important – instruct. Keep these things in mind when you interview and write letters of application.

During the interviewing process, it's important that you seek out information to insure your compatibility with the camp. Try to pin down the director's outlook and goals for the radio program. Get in touch with past radio counselors at the camp to discover their problems and what to expect from the campers and administration. Since the camp will probably be too distant to visit, it's a good time to get opinions on such things as facilities, policies of the camp, and staff relations. Usually camp directors request critiques from specialty counselors at the end of a season, and it would be wise to obtain the latest report.

When things are pretty well squared away between you and the director, there

always exists the question of salary and expenses. Almost all private camps will give you a travel allowance that will cover ninety percent or better of your round trip if you travel frugally. Expect $50 to $100, depending on how far you live from the camp. Many camp directors will allow you to suggest your salary requirements, and it's one time you don't want to sell yourself short. Directors have difficulty finding qualified radio people, mainly because they can be employed elsewhere at higher wages. They are willing to pay if they are impressed with you. Expect upwards of $600 *plus* travel allowances. In addition, you'll receive free room and board and weekly laundry service.

All reputable camps will present you with a contract outlining your wages and any additional duties to be assigned. Be sure to assert yourself to the director that you are a radio specialty counselor, and for the program to be successful, your radio duties must have priority. A less dynamic radio counselor will often find himself saddled with waterfront or athletic duties, which are not that undesirable, but do detract from a successful radio program.

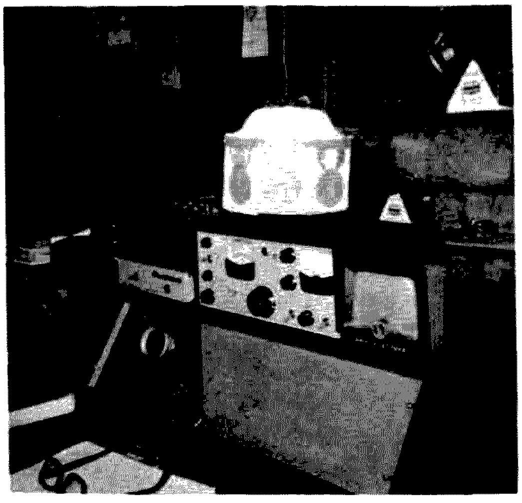
You'll probably discover that the camp already owns some radio gear, and if you are lucky, maybe an SSB transceiver. Usually camps will have a healthy junkbox and a supply of tools, soldering equipment, etc. Don't forget that you're going to need a key and a practice oscillator for code sessions. In addition, most camp directors would be happy to pay shipping charges on any personal gear that would enhance the program. A word of advice here: if you decide to ship any gear via any of the freight services, obtain a footlocker and use your spare clothing to pack it as tightly as possible.

By now you probably know what antenna system the camp has installed, but you may have to allow space in the footlocker for some coax and wire. It would also be wise to take along a small VOM and a few alligator clips. Perhaps the director by this time has forwarded an inventory to you to allow you a little more certainty of available materials. Of course, you'll want to be sure to have a copy of the *Handbook*, and some of the *73 License Study Guides* would be helpful. I used both sources. The *73 License Guides* are excellent texts on which to base a course.

Once you are there, it's good advertising to arrange the shack as attractively as possible. This is for your convenience, that of the campers, and for the director's guests who are likely to appear during the summer.

The overall programming at these private camps is designed to keep the children "in activity." This means that there may be four to six periods split between the morning and afternoon during which the campers are scheduled to, or elect to, attend various activities. At this point, it's necessary that the director and programming personnel understand the academic nature of theory and Morse code sessions. Since radio is a relatively new thing at a lot of these camps, their tendency is to handle radio like any other activity. As anyone who has pursued a ham license would know, code and theory classes must be presented on a regular basis for best results.

During the first week of camp, the object is to expose as many youngsters as possible to the lure of your activity. For the younger groups, the thrill of talking over the ham radio is certain to stimulate a likely chalk talk of what happened. The older fellows can generally get interested in



The shack at camp, WA8MLG/1. The setup provided many thrilling demonstrations for the campers.

View from the shack window.

demonstrations. For example, try using a small AM broadcast transmitter to transmit campers' voices to a radio. Following this, the campers are inevitably curious to know why the things worked, which leads into a block-diagramming chalk talk.

During the second week, you'll probably be scheduled for the remaining groups and certain "optional periods" during which the campers may appear for additional radio instruction. The second week is also an important one as far as you're concerned. By now you'll be familiar with the aptitudes of the campers and be able to spot the shiny, excited eyes that betray a potential radio addict. Many boys will be inquiring about ham licenses and practicing on their own the ten or so Morse code characters you've taught them.

This is the crucial point that can make or break a good camp radio program. Many campers like to tinker with almost anything, and will add radio to their tinkering lists. Many of this genre will not be gung-ho about getting their amateur tickets, but will want to learn more about electronic gadgetry. The other variety of camper is generally the older group (and the non-athletic type) who go in for the challenge of the code and theory. As I discovered, it is necessary to divide these two different types for separate class sessions. Not only does it preserve your own sanity, but it permits more rapid learning and progress for the campers.

When you do this pen and paper juggling act, there are a couple of things to consider. When you request such a separation for the program, you'll be tampering with the administration's programming, which at some camps is considered sacred. Secondly, by this time you should have some idea of construction projects in mind for the groups. You'll discover that construction projects are almost a necessity. After school's out for the summer, most campers balk at a continual diet of lectures and demonstrations. They want to do things with their hands, something electronic that is workable. So, in addition to the two lecture groups, you'll need two lab sessions, or at least one separate lab for the advanced group.

Projects are a consideration in themselves. For the first group, simple transistor radio kits make a nice project when several weeks are taken to explain and construct them. It's the learn-as-you-build approach that retains their interest. The licensing classes will probably want to try their hands at more advanced things like transmitter or receiver kits. My star pupil did a beautiful job of the Heath HW-16 Novice transceiver. It's also a time for the counselor to recognize his own technical limitations.

After all this is on paper, pack up your wit and persuasion and present it to the administration. Assuming you can be guaranteed definite scheduling for your groups, the next bugaboo is projects. These are

Camper with his completed HW-16.

generally ordered from any radio supply house by phone for fast delivery, with simultaneous financial arrangements with the parents. Out of twenty boys in my group, the parents of only one thought the camper couldn't complete a project. As I mentioned before, parents are pleased to see their children dabbling in electronics.

As far as teaching the program, it's largely up to your own doing. The basic radio group will enjoy demonstrations and lectures on simplified theory in addition to their lab. This group will probably shape the course themselves, with the variety of questions you will have to field. In the licensing classes, it's necessary that it be disciplined enough so that Novice examinations can be given during the last week of camp.

As far as licensing procedures go, it is wise to give the FCC three weeks to handle your 610 forms and volunteer examiner certification. If you are under 21, the ARRL will be glad to supply you with a few addresses of qualified hams near the camp. Write them all, explaining the situation, and invite any takers over for lunch on the day of the exam. I wrote to three amateurs and all three responded affirmatively, and I had the awkward pleasure of refusing two. It only testifies to the helpfulness of the radio fraternity.

In addition to your radio program, you can expect much more from the summer. You'll probably be assigned "bunk duty" which means you'll share bunk supervision with another staffer over ten or so campers of the same age group. I found bunk duty to be a great break from the shack and a fine experience in learning about children and helping them to grow. You'll probably be asked to help set up a PA system occasionally, and maybe even operate a movie projector. There's still plenty of time to enjoy waterfront and sports activities in addition to evening ragchews with the gang back home. On your one day off per week, you are free to tour the surrounding countryside. Above all, the letters you'll receive later on from your summer camp boys will put the icing on the cake. Have a good summer, and good luck!

. . .WA8MLG

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THE DOUBLE COAXIAL ANTENNA

A simple antenna form that provides essentially the same performance characteristics as a folded dipole antenna but with direct coaxial-line feed requiring no baluns or other matching devices

The folded dipole antenna is one of the most popular antenna forms used by amateurs. This is still true today, although the folded dipole has declined a bit in popularity over that which it enjoyed in the 1950s. The reason for the decline in popularity is undoubtedly due to the fact that the usual folded dipole cannot be directly fed with a coaxial transmission line. The usual half-wave folded dipole constructed of 300Ω twinlead must be fed with 300Ω transmission line and a balun used at the output of a transmitter having a 50-75Ω coaxial output, or the antenna can be fed with coaxial transmission line and a balun transformer used at the antenna. In either case, a certain amount of inconvenience and expense is involved. Some amateurs simply do not want to add the necessary components to the antenna system and settle for the use of a simple dipole which can be directly fed with a coaxial transmission line.

Anyone who has ever used a folded dipole, however, will usually notice the difference in performance between a folded dipole and a simple dipole. The folded dipole antenna has a much broader bandwidth and far less retuning of a transmitter is required as frequency changes are made within a band. On the higher frequency bands especially, one can often QSY across the entire CW or phone portion of a band without having to touch the output tuning on a transmitter (assuming a relatively low Q transmitter output circuit).

Also tied in with its bandwidth characteristics, the folded dipole seems to be far less sensitive to its physical placement effecting its swr. Thus a folded dipole can be put up in many situations where the antenna legs must be bent or otherwise not run in a straight line and still perform well. A regular dipole erected in a similar situation may well have to be carefully pruned to work well on a narrow portion of a band. Sometimes operators who use a folded dipole after having used a simple dipole claim that the folded dipole performs better. This is usually only true because the simple dipole was not carefully matched to begin with, or the relatively severe frequency bandwidth limitation of a simple dipole made of thin wire was not fully realized.

After the above discussion, the reader may expect that the antenna to be described in this article is some new form of folded dipole. That is actually not the case, although the antenna described does have the performance characteristics of a folded dipole but with a direct coaxial transmission line feed. It basically adapts the desirable features of the folded dipole antenna form to the present day almost universal use of coaxial transmission lines without requiring the use of any impedance matching devices. The antenna form described dates back to at

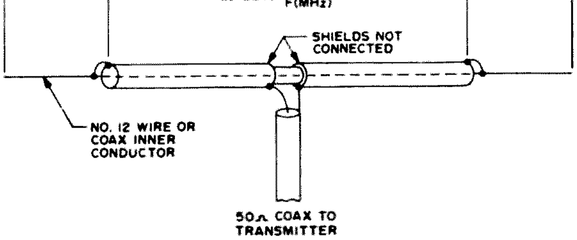

Fig. 1. Basic dimensions of the double-coax antenna.

least WW II days but then most transmitters had balanced outputs and a regular folded dipole was a more convenient antenna form to use.

The basic dimension of the double-coax dipole is shown in Fig. 1. Note that the shield of each coaxial line section in the antenna flat-top is connected to the inner conductor only at the outer end of each section. The shield of each coaxial line section at the center of the antenna is not connected to the inner conductor, but only to the coaxial transmission line.

The electrical operation of the antenna may not be apparent at first glance but it is basically simple. If one forgets for the moment that each coaxial section in the antenna flat-top has an inner conductor, it will be seen that the shield of each section and the wire extension at the outer end of each section form together a simple dipole antenna. Considering then the inner conductor of each coaxial section, each coaxial section forms a shorted stub placed across the dipole terminals. Since each stub is less than 0.25λ long, it produces an inductive reactance. As shown in Fig. 2, the reactance of the shorted stub varies as its effective length varies with frequency and the reactance at the antenna terminals of a simple dipole vary with frequency as the effective length of the antenna changes. The overall result is that over a broad portion of each band, the reactances cancel each other and the input impedance of the antenna remains essentially constant. This is true because the resistive portion of the antenna impedance varies in value slower around the resonant frequency of the dipole than does the reactive component of the impedance.

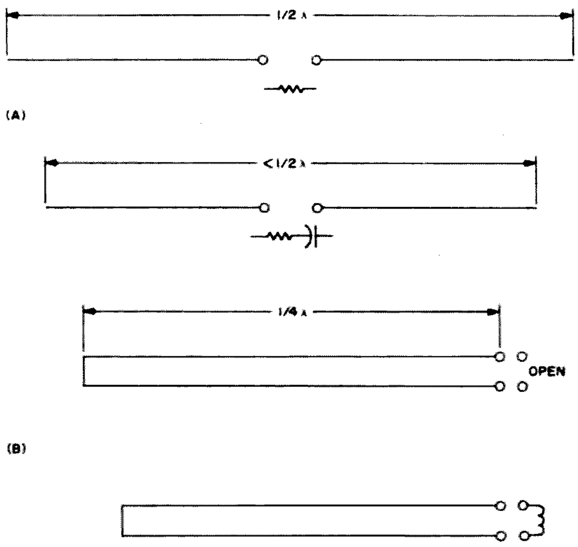

Fig. 2. Basic operation of antenna depends on fact that slightly shorter than ½λ antenna (A) presents capacitive terminal reactance while slightly shorter than ¼λ shorted stub (B) can present compensating inductive reactance.

Construction

The antenna can usually be constructed without the use of any special materials. It is not necessary to use the same type of coaxial cable for the stubs in the flat-top portion of the antenna as is used for the transmission line. Usually, however, it will be convenient to do so. In any case, a 50Ω coaxial tranmission line should be used to feed the antenna.

The center connector for the antenna can be a coaxial tee if care is taken to insulate the necessary portions of the antenna. That is, the shield of one of the coaxial sections in the flat-top will have to be insulated from the coaxial connector going into the tee and connected via an external wire lead to the center conductor of the coaxial transmission line which feeds the antenna. The center pin of the coaxial connector used for the coaxial transmission line into the tee connector also has to be removed.

An alternative to the use of a tee connector is to simply construct a center connector using a small piece of 3 x 3 in. Bakelite, or similar insulating material, as shown in Fig. 3. Simple hardware store U-clamps are used to hold each coaxial line section in place. Once the connector is constructed and wired, it should be thoroughly covered with a good coating of insulating varnish both to prevent the hardware components from rusting and to prevent moisture from entering the exposed ends of the coaxial lines. The use of this type of connector does not require that the length of coaxial line used in the flat-top portion of the antenna be cut in the middle in two pieces. Thus, the flat-top portion of the antenna gains added mechanical strength.

Figure 1 shows the end sections of the antenna flat-top as single pieces of wire. This

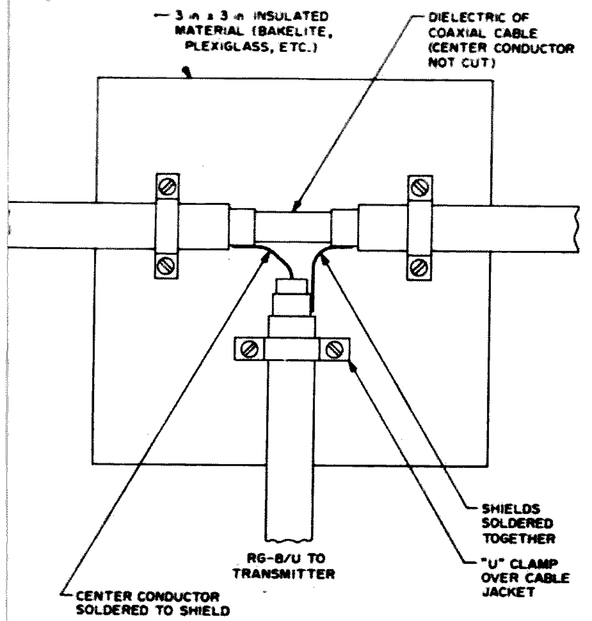

Fig. 3. Simple home-brew center connector for antenna easily interconnects coaxial lines. Finished assembly should be weather protected with varnish.

type of construction will suffice for operation over almost all of every high-frequency band except 80m. The swr will generally be less than 1.5:1 over a band. If some additional "peaking up" is desired to optimize the swr in some portion of a band, this can be done by varying the length of the end sections. Generally, this procedure is not necessary nor will it provide any worthwhile improvement. For maximum bandwidth on 80m, the end sections can be made from a "fan" of several wires joined together at the points where the coaxial sections are shorted. The center wire in the "fan" should have the length of the single wire end section as calculated from Fig. 1.

Summary

It would be nice to claim that the antenna form presented is a new one. Such is not the case, however, although the antenna will be new to many amateurs and should solve many of the operational problems encountered with simple wire dipole antennas. Certainly for the expense of a bit of extra coaxial line, anyone about to construct a single-band dipole antenna should seriously consider the advantages of the double-coax antenna.

. . .W2EEY

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AN ULTRA-RELIABLE NON-FALSING TONE DECODER

Once a simple repeater has been constructed and debugged it is quite natural to consider the addition of extra receivers, autopatch, etc. To graduate from the simple single receiver transmitter to a complex and sophisticated machine is basically quite simple. The basic holdup in my experience is a simple foolproof method of controlling "extras" in an advanced repeater from the car or base station. The first and most sensible method of remote control is of course in band signaling or tone control. Basic problems exist with this inasmuch as users' voices, touch tone dialing of autopatch units, etc. contain frequencies in the "in band" (300–3000 Hz band). When voices, noise or other undesirable short term energy falls in the pass band of the decoder, unwanted tripping of control circuits occurs. This problem, which is quite real, can cause serious control difficulties to the home-designed and some of the commercially available decoders. Other problems such as temperature, unstable frequency determining elements, critical input level adjustments, high Q LC, ringing problems, etc. discourage most people from ever even thinking about tone control for repeater or other voice channel operation. As black as the tone control picture appears from above, useable and very reliable control can be utilized by careful design and the use of modern micro circuits.

The circuit to be described is a design which has been in use in many amateur repeaters, fire department radio control of town sirens, and call up of auxiliary firemen. The heart of the decoder is a recently available micro circuit, a Signetics NE 567. Within its little 8 pin DIP body lies approximately 60 transistors. They function as a highly stable phase locked loop with detection and logic output circuitry. Frequency and bandwidth are independently adjustable externally. With the pot shown between pins 5 and 6 of the NE 567 the frequency is adjustable between 500 and 3000 Hz. The internal oscillator is available at pin 5 so decode frequency can be set very accurately with the use of a digital counter. Pin 8 provides an output transistor from the decoder; when a signal is being decoded, the output transistor conducts turning off Q1. The 270K resistor and 2 μF capacitor form a time constant of approximately 1 second. With Q1 off, the C charges. If and only if the decoded tone remains for 1 second will the voltage in the 2 μF reach the firing point of Q2, a unijunction. If the tone does not remain for a full second, the output transistor in the NE 567 turns off and in turn Q1 conducts, discharging very rapidly the 2 μF capacitor. Using this method of non linear integration, transients, voice peaks, etc. cannot trip the decoder. A steady frequency stable tone of 1 second duration is all that

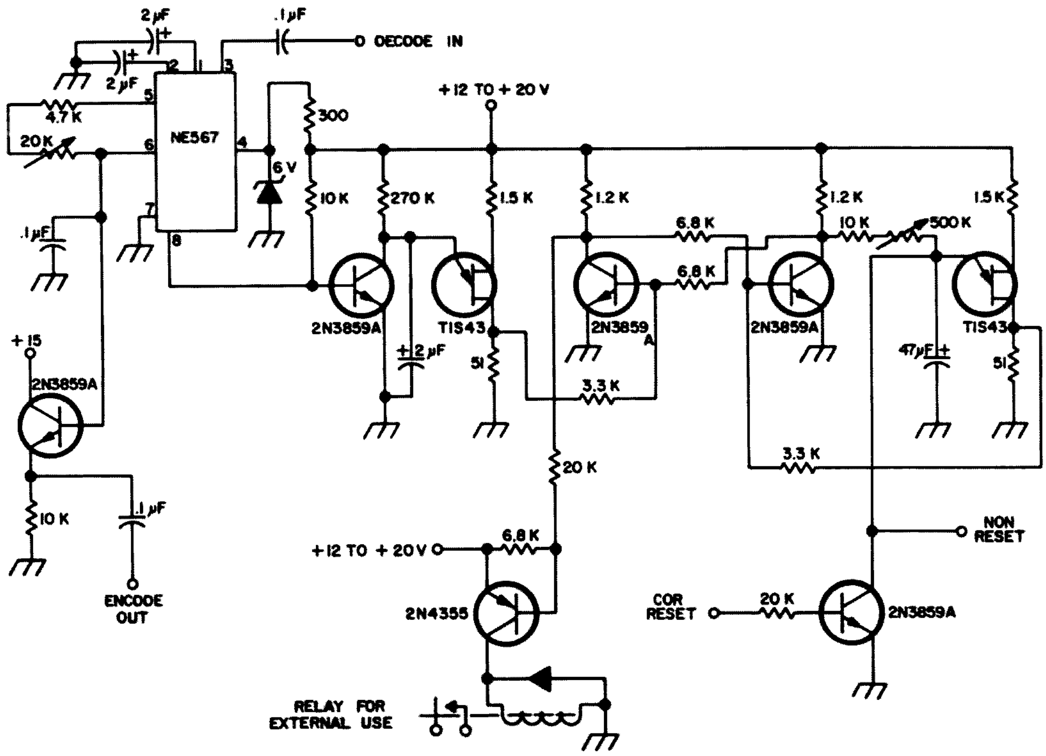

Fig. 1. Schematic. All transistors 2N3859A unless specified otherwise.

can fire Q2. When Q2 fires, it pulses the base of Q3 which with Q4 forms a flip-flop. Q3 conducts causing Q4 to open. A time constant formed by the 10k, 500k pot and the 47 μF capacitor will then begin to charge. When the firing point of Q5, another unijunction, is reached a pulse will be delivered to the base of Q4 resetting the flip-flop to its original state. If the COR input to Q8 is made positive any time during the charging of the 47 μF capacitor it will be dumped very quickly and will not allow the flip-flop to be reset by the unijunction. In this way, a function can be "toned" in and kept in operation until no COR is produced by the repeater or other device for a set period of 1–30 seconds. If a function is to be kept on (or off) by the decoder, pin 6 can be grounded, thus not allowing the reset timer to work. Pins 3 and 4 provide normally open contacts that close when tone is decoded. These contacts will open when reset timer resets the flip-flop or Q4 collector is grounded by external means. Q6 is an emitter follower providing low impedance tone output from the NE 567 chip. This output can be used to encode another unit similar to the one described, such as mobile to mobile tone burst applications.

Another use for this feature being put into use locally is to control voice coil connections with the relay RLY1 so that base station monitoring of a crowded repeater channel is endurable. When someone wishes to communicate with a so equipped station, a 1 second tone burst is all that is required to open the speaker. Using the timed turn off option, messages can be left on a tape recorder via a repeater without using excessive tape. One of these decoders was recently put into use to access an autopatch on a small private repeater. This provided a quickly constructed full autopatch hookup for a group that did not want to get involved with large "open" repeaters.

These boards completely assembled and tested are available from *Hoffman Electronics, 169 Millham Street, Marlboro MA 01752.* The cost including postage within the U.S. is $35.00. No COD's. I think you'll find this decoder circuit a joy to use and as indispensable in repeater operation as "COR's."

. . .W1ELU

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AN AMPLIFIED, CALIBRATED, SIGNAL STRENGTH METER

Tune quads, coils, mobile whips, all sorts of things with this simple resettable device.

Recently, I had the problem of tuning a four element quad. As you may or may not be aware, these beasties are supposed to be tuned from the rear for minimum signal. A quick check showed none of my friends had a signal strength meter, so I prepared to degrade myself and buy one. A look at a few prices convinced me to build.

Since I wanted some other information on the quad, like front to back ratio and the effect of more or fewer elements, I decided to add a calibrated attenuator and enough gain to make a fairly wide input range. It also had to be cheap!

The result is shown in Fig. 1.

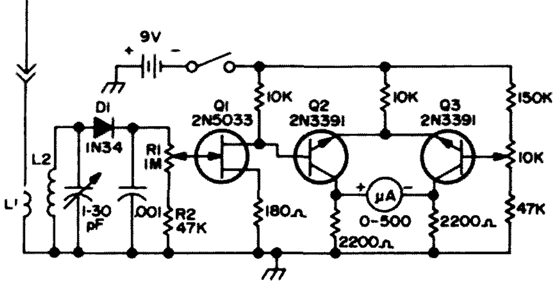

Fig. 1. Diagram of the field strength meter.

To use the normal rf attenuator method of switched T-pads requires complicated shields and quite a few resistors. Also the attenuator has to be terminated in its characteristic impedance to read correctly. To bypass this problem I first detect the rf, then attenuate the dc. This has the added advantage that the circuit is no longer frequency sensitive.

The incoming rf is tuned by C1-L2. C1 can be any small variable. I used both sections of a dual 15 pF because my local surplus store has them for 60¢. For VHF use only 1 section.

L2 is wound on a plastic pill bottle about 1" in diameter and tapering to 7/8". To cover 13–24 MHz, I used 11 turns spaced over about an inch. L1 is 2 turns over top of L2. I tried bandswitching with another pill bottle fastened on the other side of the shield from L2. The idea was to bandswitch another frequency range but I find it more convenient to wind on coils as needed. Use the grid dipper to get you in the ballpark. I have used this meter as high as 72 MHz without trouble. D1 can be any diode. I used a 1N34 because I could then specify it and know it would work, but I tried a computer type which also worked. If you prefer the meter to peak rather than dip, reverse D1.

Rectified rf from D1 is put on the top of R1, the calibrated attenuator. R2 in series with R1 gives the 0 dB point at its junction. For a 30 dB range, R2 is 47K if R1 is 1 MΩ This doesn't quite fill the range but is close. Changing the value of R2 will change the

range but 30 dB is considerably more than the F/B ratio of most beams.

Q1 is a 2N5033 FET. The high input impedance of Q1 allows us to set the calibration of R1 directly by dc voltage measurements on the VTVM since it does not draw any base (gate) current. It is a p-channel device. If you use an n-channel type you will have to change the entire biasing of the circuit and also reverse D1.

Q2 and Q3 form a differential amplifier to drive the meter. Q2 is necessary to avoid loading Q1 and I had quite a bit of trouble balancing the meter against battery voltage changes until I added Q3. It will now operate from 8.5–9.2 volts with no trouble. The 10K pot in Q3's base centers the meter. The meter I used is a 250 μA tuning meter with no markings on it except a red/white/blue bar. This is all you need since we calibrate on R1, not the meter.

Operation

The meter is quite sensitive and with a two foot antenna I could get a reading several hundred feet behind my quad at 60 watts input. First tune the input (which is quite sharp) with the attenuator set at zero. This is the least sensitive position. Now set the meter for a convenient reading near the center scale with the incoming signal still on using R3. Adjust your antenna. When you feed it power again the reading will not be quite on scale on the meter but turning up R1 will allow you to put the meter back to the original position. Do not touch R3. The reading on R1 is now the increased gain in dB needed to bring the signal back to its original strength. In other words, the decrease in signal strength.

Note that during measurements you need a received signal to use R1. With no signal the meter will be off scale.

I have also used the meter to align oscillators and doublers in my two meter receiver. A probe can be made for this from two turns of wire on the end of a piece of coax. The high gain available allows the pickup loop to be quite far away which reduces detuning. Adjustments show up well on the meter.

. . .VE3CES

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NICKEL-CADMIUM BATTERY PACK FOR PORTABLE FM

The nickel-cadmium battery pack described in this article was designed to match my two meter transceiver. This home brew project was undertaken to equip the transceiver for portable operation in the field away from the car or ac power. The construction mainly involves cutting and bending sheet aluminum. The entire project can be completed in about three or four evenings.

Considerations

My unit is a 12-channel, solid state FM transceiver capable of 10 watts of rf output. My transceiver case measures about 3½" x 8" x 7½" and it weighs about 8½ lbs. It operates to full specifications at 13.8V dc and gracefully degrades as the voltage is decreased. Measured current requirements are 2.5 A transmit, 220 mA standby and an average of about 220 mA receive.

Overall, the electrical characteristics of the unit lend themselves to battery operation, except for the relatively high battery drain in the receive and standby conditions. The drain can be reduced by about 120 mA by switching off the pilot lamps.

The station junk box was the source of 10 size D nickel-cadmium cells which were saved for such an occasion. These cells are mounted in a plastic "egg crate" measuring 7½" x 3" x 2½". Fortunately, the plastic

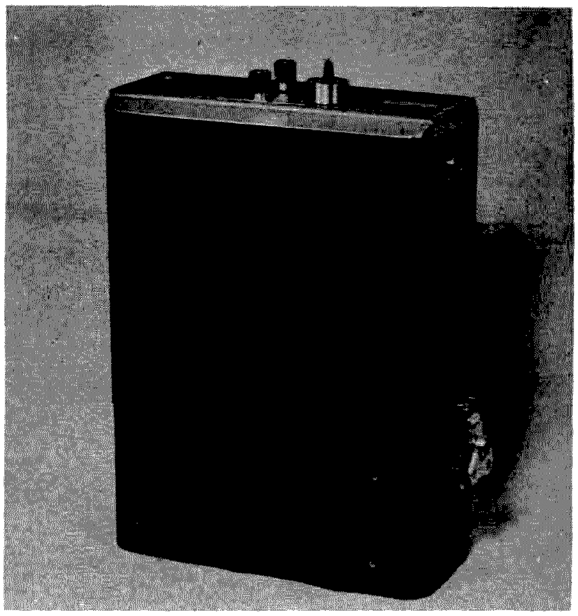

Photo 1. Bottom view of transceiver and nickel-cadmium battery pack.

container proved to be a perfect fit for the outline dimensions of the transceiver. The same is true for F cells which have the same diameter as the D cell but are somewhat longer. The capacity of a nickel-cadmium F cell is 6.5 Ah at the 5-hour discharge rate, while that of the smaller D cell is 4.0 Ah. Although the larger F cells were preferred, none could be located at low or no cost. So the D cells were used.

Construction

The basic box is constructed of 0.063-inch thick sheet aluminum. The top consists of a sheet folded at right angles 1½" from each end to match the top of the transceiver cabinet. The length of the top is 3½".

The bottom of the battery box is somewhat difficult to form using tools available to the amateur. So, after some experimenting, I elected to cut the top and bottom covers so that they just meet. The joint was made by mounting a 3½" x 3/4" aluminum strip inside the seam. The bottom of the strip is secured to the bottom cover by means of two aluminum rivets. The top of the strip is joined to the top cover with two small metal screws. Like the top cover, the bottom cover is cut to a length of 3½". The difficulty with the bottom cover is bending the corners to match the transceiver outline. The start and finish of each bend were first determined by measuring the transceiver bottom cover by making pencil marks on masking tape. These marks were then transferred to the aluminum sheet to be bent. Numerous slight bends were then made between these marks until the original bend was virtually matched. An aluminum break was used. An expedient is to use a bench vice and several pieces of hard wood.

The back cover of the battery box (not shown in the pictures) is a flat sheet of aluminum with the corners rounded to conform to the outline of the case. The back cover is secured by 4 machine screws that mate with nutplates riveted to the top and bottom covers.

The front panel is formed from sheet aluminum cut to size. The four corners are cut off diagonally, and the last 1/2" margins on all sides are folded at right angles. A chassis receptacle and guide pin are mounted on the front panel to mate with the rear panel of the transceiver. The battery box front panel is secured to the top and bottom covers by four metal screws.

The plastic "egg crate" needs to be cut down on two of its corners to conform to the rounded corners of the bottom cover of the battery case. A power drill and sanding disc can be used. Depending on the length of the metal screws used to complete the seam between the top and bottom covers, it may be necessary to cut an additional groove on each end of the "egg crate." When the batteries are inserted and the battery box is assembled, the "egg crate" is held securely around the edges by the folded margins of the front panel and the nutplates used to mount the back cover.

Finishing

After the aluminum work is finished, the corners and edges should be filed smooth. Emery cloth is used to remove any scratches, and a buffer may then be used if one is available. Before painting, it is important to remove all dirt and grease. This is best done by taking the aluminum parts to a shop with anodizing or other suitable finishing process. A fair substitute is to clean the aluminum with alcohol. After the aluminum is cleaned, it should not be touched with the hands and should be painted as soon as possible.

A search of the local paint stores and a few random inquiries failed to turn up an answer on how to match the paint used on my rig. Apparently, it is a sputtered semi-gloss epoxy enamel. Rather than to prolong the search, black wrinkle varnish was used

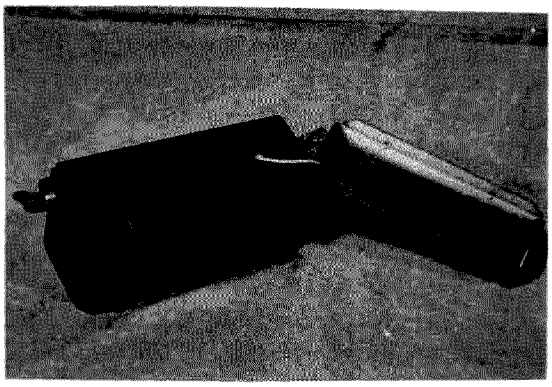

Photo 2. Nickel-cadmium battery pack with front panel open to show individual cells in their plastic "egg crate."

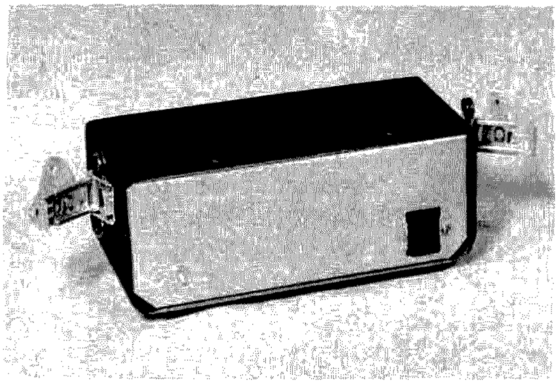

*Photo 3. **Nickel-cadmium battery pack front panel showing 6-pin "Jones" receptacle and guide pin.***

on all parts of the battery box except for the front panel. The painted parts were baked in a 250° oven for 15 minutes.

Following the painting, four rubber bumpers (feet) are riveted to the bottom cover. Rivets are used because the "egg crate" does not leave enough room for the nut and screw normally supplied with the bumpers.

Wiring of the receptacle is simple. Heat-shrinkable tubing is used to cover each solder connection.

The final touches are the addition of the guide pin and catches on the sides of the battery box. Suitable catches are somewhat hard to find in the usual electronics or hardware stores. The catches used were from someone else's junkbox, and their origin is unknown.

Charging

Nickel-cadmium D cells (when fully discharged) should be charged for 14 hours at a constant-current rate of 400 mA. When discharged, the voltage is about 1.0 to 1.1 volt per cell. Near the end of its charging cycle, the voltage is 1.35 to 1.45 volt per cell. After settling down after a charge, the voltage should be nominally 1.25 volt per cell. If you have one in the shack, a dc bench supply with voltage and current meters can do a nice job of charging nickel-cadmium batteries. Or, a small battery charger could be built from available parts.

An ac power supply can be used as a constant-voltage charger for the nickel-cadmium batteries. When the battery is initially placed on charge, the charging current is high. The current tapers to a trickle as the battery approaches end of charge.

Switching Lamps Off

Because the two pilot lamps used in the transceiver draw about 120 mA, it is desirable to eliminate this drain when operating from batteries. A ground rule for the switching scheme was that this be a "no holes" modification to maintain the resale value of the transceiver. After some thought, a magnetic proximity reed switch was chosen. An SPDT type was selected and wired so that the lamps would be normally on. The reed switch is mounted on a small aluminum bracket and is located immediately behind the front panel just below the panel meter. To turn off the lamps a bar magnet is placed over that section of the front panel. Some rubber cement helps the magnet stay in place yet leaves no permanent residue.

If you have never worked with magnetic reed switches, a word of caution is in order. If you plan to bend the leads, long-nose pliers should be used to hold the wire to provide some relief to the delicate glass envelope.

Results

In theory, if you use the battery on an 80/10/10% (standby/receive/transmit) basis, the power required for one hour of operation should be as follows:

48 min, 80% standby (.8h x .08A) = 0.64 Ah
6 min, 10% receive (.1h x .10A) = 0.01 Ah
6 min, 10% transmit (.1h x 2.5A) = 0.25
Total for 1 hour of operation = 0.90 Ah

Thus, if you divide 0.9 Ah required for 1 hour of operation into the total of 4.0 Ah available from the battery, the battery life should be 4.4 hours per charge. However, most (alas not all) amateurs listen much more than the arbitrary 80/10/10 formula would suggest. So far, an average of 6 hours operation per charge has been obtained.

Summary

This battery pack can be constructed by the average amateur in several evenings. It will operate the average FM rig for more than 4 hours in the field or during emergency power outages. The construction techniques are straightforward and may be modified to suit other solid state equipment.

. . . K4YKB

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An Ohmmeter that develops only 250 mV accross its terminals will take the headaches out of checking circuitry that fools the average VOM.

AN OHMMETER FOR SOLID-STATE CIRCUITS

It might appear neither relevant nor timely to state that an instrument for making quick resistance-measurements is indispenable in servicing and development work. It certainly is true that the VOM and the electronic meter have been with us for many a moon. And look at the recent sophistications and improvements – taut-band meters, VOM's with 20,000Ω per volt and even greater sensitivities, FET "front ends," digital VOM's, etc. Quick resistance-measurements, indeed! *Where is the problem?*

Have you ever tried to trouble-shoot a PC board loaded with semiconductor devices as well as resistors, capacitors, and maybe inductors, transformers, and you-name-it? Chances are it proved deceptively difficult because the 1½V developed between the test prods of the ohmmeter forward-biased various PN junctions, thereby making resistance measurements questionable, indeterminate, and downright bewildering. Oh sure, reversing the polarity of the prods can pay dividends, but in a complex circuit it is often only possible to make limited progress in this way. Besides, it is a pain in the neck because one has to constantly analyze and practically redesign the circuit in order to ascertain which way the prods should be applied.

How much nicer it would be to be able to move nimbly from point to point, or component to component, and not have to worry about the shunting action of PN junctions. For example, consider the typical audio amplifier. Suppose the circuit is inoperative and it is desired to check all components with the ohmmeter. We could remove all of the semiconductor devices and then apply the ohmmeter test prods to the remaining components. In this way a bad or wrong-valued resistor could be readily found, as could a leaky or otherwise defective capacitor. If none of the remaining board-components are faulty, we could then concentrate on the semiconductors (or for that matter, the semiconductors could be checked first).

The only trouble with the above procedure is that the semiconductors are often *soldered in place.* Removing them is very time-consuming and more likely than not, thermal damage will be inflicted as one's patience depletes during extrication of a stubborn element. There just has to be a better way! One can purchase a VOM or electronic meter with much less than six-hundred millivolts developed between the test prods. Such an instrument will ignore healthy solid-state elements, greatly facilitating test procedure.

Another way to fly is to rapidly and inexpensively construct a special ohmmeter

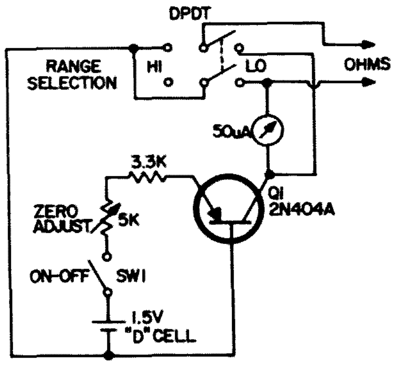

Fig. 1. Schematic circuit of the ohmmeter for solid-state circuits. Transistor Q1 need not be a 2N404A. Any small signal PNP germanium type will work.

for testing solid-state circuits. I have developed a simple but effective ohmmeter which I will now describe.

Figure 1 shows the circuit of the low-voltage ohmmeter. Only about 250 mV are developed across the test prods, far below the value capable of forward-biasing silicon junctions in solid-state devices. But what have we here? A dc current meter is in the collector-base circuit of a transistor connected in the common-base configuration. Emitter-base bias is provided by B1, but look as one may, there is no obvious source of collector bias. Nor is there any subtle or tricky current path for polarizing the collector. How then can the transistor deliver current to the meter? Actually, this is a valid way of utilizing the characteristics of a transistor. Although infrequently encountered, a transistor so employed is capable of providing collector current with zero-applied collector voltage! In so doing, the transistor develops about 250 mV between collector and base (this is the maximum voltage available at the test prods). Although this mode of transistor operation is not generally useful, it is just what the doctor ordered for our purpose. It should, however, be realized that a *germanium* transistor such as the 2N404A must be used.

Other than the unique current-source for the microammeter, this ohmmeter operates in the same manner as conventional instruments. Note the range switch, SW2, enables the meter to be used as a shunt-type ohmmeter for the low range, or as a series-type ohmmeter for the high range.

Popular 20,000Ω per volt VOM's employ 50 μA meter movements which have an internal resistance in the vicinity of 5000Ω. On many of these instruments, a 50 μA current-measuring function is provided. However, rather than clutter up the already congested scales of such meters with additional markings, it would appear desirable to make a conversion table relating microamperes to ohms. Inasmuch as this introduces an inconvenience during test procedures, the best bet is probably to obtain a 50 μA dc current meter. Then one is free to inscribe high and low ohms calibrations as shown in Fig. 2. This drawing is intended as a general guide and is very approximate. So-called 5000Ω meters will vary considerably in actual resistance and it would not be practical to provide a universal template for transferring scale markings to meters. Meters also vary in linearity and accuracy. It is much better to calibrate the individual meter even though accuracy may not be the primary goal in a meter for generalized trouble-shooting.

With regard to scale calibration of the meter face, the ensuing procedure is a straightforward way to get a reasonable start. Acquire *pairs* of the following 5%, ½W, composition resistors: 10, 100, 1000, 10K and 100KΩ. According to the way each pair is used (parallel, singly or series) we then have *at least* the following calibration values:

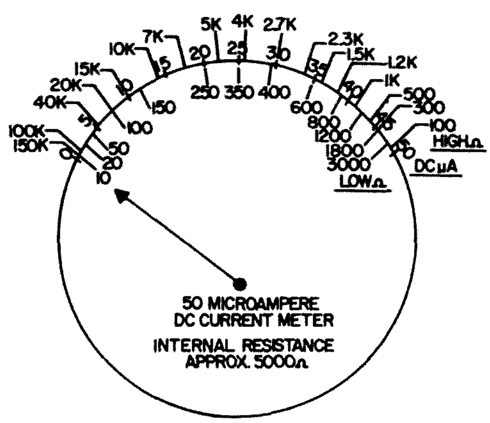

Fig. 2. Approximate appearance of high and low range ohms scales. To be used only as a guide. Actual calibration is made with the use of known resistances.

5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5K, 10K, 20K, 50K, 100K, 200K. By appropriate combinations of different values, one readily comes up with such values at 70, 700, 7000Ω, etc., or approximately 14, 140, 1400, etc. Additional resistors can be obtained for more extensive calibration. Decade values are the most useful. Caution should be exercised in any attempt to interpolate calibration markings – this just is not easy to do on a scale as nonlinear as that of an ohmmeter. Two scales are calibrated on the meter face, one for the high ohms-range, and the other for the low-ohms range. The extremes of the high range are 100Ω and 150K. The 150K marking is close to the zero of the 50 μA scale. The extremes of the low range are 10Ω and 3K. The 3K marking is close to the "50" of the 50 μA scale. When calibrating, frequently check the zeroing of the meter. This is accomplished by means of R1. On the high range, an exact full-scale meter-deflection must exist with the test prods *shorted.* On the low range, an exact-full-scale meter-deflection must exist with the test prods *apart.*

The total measurement range of this ohmmeter is ten to one-hundred thousand ohms with useful estimates possible somewhat beyond this range. It happens that such a range is adequate for the majority of tests in solid-state circuits. Although megohm resistance values are occasionally encountered, the pronounced tendency is for the resistances to range from several tens of ohms to several tens of kilo-ohms.

To use the ohmmeter simply place switch SW1 in its ON position and zero the meter (full-scale deflection, or 50 μA on the current scale) by means of R1. If range switch SW1 is on "high-ohms," zeroing is accomplished with the test prods shorted. If SW2 is on "low-ohms," zeroing is accomplished with the test prods apart. As with a conventional ohmmeter, ascertain that no voltage sources are active in the circuitry to be tested. In using this ohmmeter, the circuit can be investigated without regard to the polarity of the test prods. This applies to electrolytic capacitors and to all semiconductor devices, except tunnel diodes. In the vast majority of test procedures using this ohmmeter, it will be unnecessary to remove solid-state devices in order to make meaningful resistance tests of the associated passive-circuitry. Possible exceptions can occur with germanium devices. In the case of germanium transistors, one can revert to the technique of reversing the polarity of the test prods. Germanium tunnel-diodes, however, should have one lead disconnected in order to free circuit tests from the effect of their conductivity. Most modern circuit-boards tend to have silicon devices. In addition to ignoring the junctions of bipolar transistors, this ohmmeter will ignore the junctions of common signal-diodes, rectifier diodes, zeners and varactors. A similar statement applies to the gates of FET's, the emitters of UJT's, and the entire family of SCR devices, including TRIACS. Insofar as I have been able to determine, one should likewise be able to ignore the presence of most IC modules. Because of the great variety and the rapid evolution of IC's, some reservation is purposely held here.

A minor, but important, detail to remember when using this ohmmeter: do not forget to *turn off SW1 when the instrument is not being used.* Whether used alone, or in conjunction with conventional ohmmeters, this low-voltage ohmmeter can add a new dimension of ease in working with solid-state circuitry. Although one need not go overboard in attaining calibration-accuracy, an interesting characteristic should be mentioned for the benefit of those who would like to exert some effort to achieve high accuracy. Unlike the ohmmeter in conventional VOM's, the precision of this ohmmeter will not be adversely affected by the aging of the cell, B1. An increase in the internal resistance of B1, or reduction of its terminal voltage or current capacity will only manifest itself as a nuisance in requiring more frequent zero-adjustments. But any time the meter remains zeroed over a measurement interval, precision will be maintained regardless of the position of the zero-adjust control, R1. If one starts out with a fresh cell, many months of stable operation should be had, providing the admonition to turn off SW1 is heeded when the ohmmeter is idle.

...W6HDM

FCC RULES AND REGULATIONS, PART 97 (I)

Starting this month, 73 will run the complete, most up-to-date text of the FCC Rules & Regulations, Part 97, pertaining to the amateur radio service. The subparts and sections reprinted each month will be listed at the head of each installment.

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SUBPART A—GENERAL

§97.1 Basis and purpose.

The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

(e) Continuation and extension of the amateur's unique ability to enhance international good will.

§97.3 Definitions.

(a) *Amateur radio service.* A radio communication service of self-training, intercommunication, and technical investigation carried on by amateur radio operators.

(b) *Amateur radio communication.* Noncommercial radio communication by or among amateur radio stations solely with a personal aim and without pecuniary or business interest.

(c) *Amateur radio operator.* A person interested in radio technique solely with a personal aim and without pecuniary interest, holding a valid Federal Communications Commission license to operate amateur radio stations.

(d) *Amateur radio license.* The instrument of authorization issued by the Federal Communications Commission comprised of a station license, and in the case of the primary station, also incorporating an operator license.

Operator license. The instrument of operator authorization including the class of operator privileges.

Station license. The instrument of authorization for a radio station in the amateur radio service.

(e) *Amateur radio station.* A station licensed in the amateur radio service embracing necessary apparatus at a particular location used for amateur radio communication.

(f) *Primary station.* The principal amateur radio station at a specific land location shown on the station license.

(g) *Military recreation station.* An amateur radio station licensed to the person in charge of a station at a land location provided for the recreational use of amateur radio operators, under military auspices of the Armed Forces of the United States.

(h) *Club station.* A separate amateur radio station for use by the members of a bona fide amateur radio society and licensed to an amateur radio operator acting as the station trustee for the society.

(i) *Additional station.* Any amateur radio station licensed to an amateur radio operator normally for a specific land location other than the primary station, may be one or more of the following:

Secondary station. Station licensed for a land location other than the primary station location, i.e., for use at a subordinate location such as an office, vacation home, etc.

Control station. Station licensed to conduct remote control of another amateur radio station.

Auxiliary link station. Station, other than a repeater station, at a specific land location licensed only for the purpose of automatically relaying radio signals from that location to another specific land location.

Repeater station. Station licensed to automatically retransmit the radio signals of other amateur radio stations for the purpose of extending their intracommunity radio communication range.

(j) *Space radio station.* An amateur radio station located on an object which is beyond, is intended to go beyond, or has been beyond the major portion of the earth's atmosphere. (Regulations governing this type of station have not yet been adopted and all applications will be considered on an individual basis.)

(k) *Terrestrial location.* Any point within the major portion of the earth's atmosphere, including aeronautical, land, and maritime locations.

(l) *Space location.* [Reserved]

(m) *Amateur radio operation.* Amateur radio communication conducted by an amateur radio operator from an amateur radio station. May include one or more of the following:

Fixed operation. Radio communication conducted from the specific geographical land location shown on the station license.

Portable operation Radio communication conducted from a specific geographical location other than that shown on the station license.

Mobile operation. Radio communication conducted while in motion or during halts at unspecified locations.

(n) *Remote control.* Control of transmitting apparatus of an amateur radio station from a position other than one at which the transmitter is located and immediately accessible, except that direct mechanical control, or direct electrical control by wired connections, of an amateur radio transmitter from a point located on board any aircraft, vessel, vehicle, or on the same premises on which the transmitter is located, shall not be considered remote control within the meaning of this definition.

(o) *Control link.* Apparatus for effecting remote control between a control point and a remotely controlled station.

(p) *Control operator.* An amateur radio operator designated by the licensee of an amateur radio station to also be responsible for the emissions from that station.

(q) *Control point.* The operating position of an amateur radio station where the control operator function is performed.

(r) *Antenna structures.* Antenna structures include the radiating system, its supporting structures, and any appurtenances mounted thereon.

(s) *Antenna height above average terrain.* The height of the center of radiation of an antenna above an averaged value of the elevation above sea level for the surrounding terrain.

(t) *Transmitter.* Apparatus for converting electrical energy received from a source into radio-frequency electromagnetic energy capable of being radiated.

(u) *Effective radiated power.* The product of the radio-frequency power, expressed in watts, delivered to an antenna, and the relative gain of the antenna over that of a half-wave dipole antenna.

(v) *System network diagram.* A diagram showing each station and its relationship to the other stations in a network of stations, and to the control point(s).

(w) *Third-party traffic.* Amateur radio communication by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of anyone other than the control operator.

(x) *Emergency communication.* Any amateur radio communication directly relating to the immediate safety of life of individuals or the immediate protection of property.

[§ 97.3 revised eff. 10-17-72, and (w) & (x) added eff. 12-1-72; VI(72)-1]

SUBPART B—AMATEUR OPERATOR AND STATION LICENSES

OPERATOR LICENSES

§ 97.5 Classes of operator licenses.

Amateur extra class.
Advanced class (previously class A).
General class (previously class B).
Conditional class (previously class C).
Technician class.
Novice class.

§ 97.7 Privileges of operator licenses.

(a) *Amateur Extra Class and Advanced Class.* All authorized amateur privileges including exclusive frequency operating authority in accordance with the following table:

Frequencies	*Class of license authorized*
3500–3525 kHz	Amateur Extra Only.
3775–3800 kHz	
7000–7025 kHz	
14,000–14,025 kHz	
21,000–21,025 kHz	
21,250–21,270 kHz	
3800–3890 kHz	Amateur Extra and Advanced.
7150–7225 kHz	
14,200–14,275 kHz	
21,270–21,350 kHz	
50–50.1 MHz	

(b) *General Class and Conditional Class.* All authorized amateur privileges except those exclusive frequency operating privileges which are reserved to the Advanced Class and/or the Amateur Extra Class.

(c) *Technician class.* All authorized amateur privileges on the frequencies 50.1–54.0 MHz and 145–148 MHz and in the amateur frequency bands above 220 MHz.

(d) *Novice class.* Those amateur privileges designated and limited as follows:

(1) The power input to the transmitter final amplifying stage supplying radio frequency energy to the antenna shall not exceed 75 watts, exclusive of power for heating the cathode of a vacuum tube(s).

(2) Radio telegraphy is authorized in the frequency bands 3700-3750 kHz, 7100-7150 kHz (7050-7075 kHz when the terrestrial location of the station is not within Region 2), 21,100–21,200 kHz, and 28,100–28,200 kHz, using only Type A-1 emission.

[§ 97.7(c) amended and Note deleted eff. 10-17-72; and (a) & (d) amended eff. 11-22-72; VI(72)-1]

§ 97.9 Eligibility for new operator license.

Persons are eligible to apply for the various classes of amateur operator licenses as follows:

(a) *Amateur extra class.* Any citizen or national of the United States who either (1) any time prior to receipt of his application by the Commission has held

for at least 1 year an amateur operator license of other than the novice or technician class, issued by any agency of the U.S. Government, or submits proof that be held for a period of 1 year an amateur operator license at least equivalent to a general class license issued by a foreign government, or (2) submits evidence of having held a valid amateur radio station or operator license issued by any agency of the U.S. Government during or prior to April 1917.

(b) *Advanced Class.* Any citizen or national of the United States.

(c) *General class.* Any citizen or national of the United States.

(d) *Conditional class.* Any citizen or national of the United States:

(1) Whose actual residence and amateur station location are more than 175 miles airline distance from the nearest location at which examinations are held at intervals of not more than 6 months for General Class amateur operator licenses.

(2) Who is shown by physician's certificate to be nnable to appear for examination because of protracted disability.

(3) Who is shown by certificate of the commanding officer to be in the armed forces of the United States at any Army, Navy, Air Force, or Coast Guard station and, for that reason, to be unable to appear for examination at the time and place designated by the Commission.

(4) Who furnishes sufficient evidence, at the time of filing, of temporary residence for a continuous period of at least 12 months outside the continental limits of the United States, its territories or possessions, irrespective of other provisions of this paragraph.

(e) *Technician class.* Any citizen or national of the United States.

(f) *Novice Class.* Any citizen or national of the United States, except a person who holds, or who has held within the 12-month period prior to the date of receipt of his application, a Commission-issued amateur radio license. The Novice Class license may not be concurrently held with any other class of amateur radio license.

[*§ 97.9(a) amended eff. 10-27-72; VI(72)-1*]

§ 97.11 Application for operator license.

(a) An application (FCC Form 610) for a new operator license, including an application for change in operating privileges, which will require an examination supervised by Commission personnel at a regular Commission examining office shall be submitted to such office in advance of or at the time of the examination, except that, whenever an examination is to be taken at a designated examination point away from a Commission office, the application, together with the necessary filing fee should be submitted in advance of the examination date to the office which has jurisdiction over the examination point involved.

(b) An application (FCC Form 610) for a new operator license, including an application for change in operating privileges, which requests an examination supervised by a volunteer examiner under the provisions of § 97.29(b), shall be submitted to the Commission's office at Gettysburg, Pennsylvania, 17325. The application shall be accompanied by any necessary filing fee and by a request for the written examination material (see § 97.29(b)).

(c) An application (FCC Form 610) for renewal and/or modification of license when no change in operating privileges is involved shall be submitted, together with any necessary filing fee, to the Commission's office at Gettysburg, Pennsylvania, 17325.

§ 97.13 Renewal or modification of operator license.

(a) An amateur operator license, except the Novice Class, may be renewed upon proper application in which it is stated that the applicant has lawfully accumulated, at an amateur station licensed by the Commission, a minimum total of either 2 hours operating time during the last 3 months or 5 hours operating time during the last 12 months of the license term. Such operating time, for the purpose of renewal, shall be counted as the total of all that time between the entries in the station log showing the beginning and end of transmissions as required in § 97.103(a), both during single transmissions and during a sequence of transmissions. The application shall, in addition to the foregoing, include a statement that the applicant can send by hand key, i.e., straight key or any other type of hand operated key such as a semi-automatic or electronic key, and receive by ear, in plain language, messages in the International Morse Code at a speed of not less than that which is required in qualifying for an original license of the class being renewed.

NOTE: Until further order of the Commission, the showing that the applicant actually operated an amateur radio station or stations for the periods of time specified in § 97.13 will not be required in cases where it is shown that the applicant was unable to conduct such operation because he was on active duty overseas in the armed forces of the United States or was duly enrolled as an employee of an agency of the Federal Government and in the course of such employment was on duty in a foreign country continuously during the last year of the license term: *Provided*, That any such employee of the Federal Government shall submit with his application for renewal of license a statement signed by his agency head, or the chief of the Bureau or Division in which he is employed attesting to such employment.

(b) The Novice Class license will not be renewed.

(c) The applicant shall qualify for a new license by examination if the requirements of this section are not fulfilled.

(d) Application for renewed and/or modification of an amateur operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's license. Application for renewal of unexpired licenses must be made during the license term and should be filed within 90 days but not later than 30 days prior to the end of the license term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(e) If a license is allowed to expire, application for renewal may be made during a period of grace of one year after the expiration date. During this one year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of its expiration. Application for renewal shall be submitted on FCC Form 610 and shall be accompanied by the applicant's expired license.

(f) When the name of a licensee is changed or when the mailing address is changed a formal application for modification of license is not required. However, the licensee shall notify the Commission promptly of these changes. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in the Commission's records, the new name and/or address, as tbe case may be, the radio station call sign and class of operator license. The notice shall be sent to Federal Communications Commission, Gettysburg, Pa., 17325, and a copy shall be kept by the licensee until a new license is issued.

§ 97.19 When examination is required.

Examination is required for the issuance of a new amateur operator license, and for a change in class of operating privileges. Credit may be given, however, for certain elements of examination as provided in § 97.25.

§ 97.21 Examination elements.

Examinations for amateur operator privileges will comprise one or more of the following examination elements:

(a) Element 1(A): Beginner's code test at five (5) words per minute;

(b) Element 1(B): General code test at thirteen (13) words per minute;

(c) Element 1(C): Expert's code test at twenty (20) words per minute;

(d) Element 2: Basic law comprising rules and regulations essential to beginners' operation, including sufficient elementary radio theory for the understanding of those rules;

(e) Element 3: General amateur practice and regulations involving radio operation and apparatus and provisions of treaties, statutes, and rules affecting amateur stations and operators;

(f) Element 4(A): Intermediate amateur practice involving intermediate level radio theory and operation as applicable to modern amateur techniques, including, but not limited to, radiotelephony and radiotelegraphy;

(g) Element 4(B): Advanced amateur practice involving advanced radio theory and operation as applicable to modern amateur techniques, including, but not limited to, radiotelephony, radiotelegraphy, and transmissions of energy for measurements and observations applied to propagation, for the radio control of remote objects and for similar experimental purposes.

§ 97.23 Examination requirements.

Applicants for original licenses will be required to pass the following examination elements:

(a) Amateur Extra Class: Elements 1(C), 3, 4(A), and 4(B);

(b) Advanced Class: Elements 1(B), 3, and 4(A);

(c) General Class and Conditional Class: Elements 1(B) and 3;

(d) Technician Class: Elements 1(A) and 3;

(e) Novice Class: Elements 1(A) and 2.

§ 97.25 Examination credit.

(a) An applicant for a higher class of amateur operator license who holds a valid amateur operator license issued upon the basis of an examination by the Commission will be required to pass only those elements of the higher class examination that were not included in the examination for the amateur license held when such application was filed. However, credit will not be allowed for licenses issued on the basis of an examination given under the provisions of § 97.29(b).

(b) An applicant for an amateur operator license will be given credit for either telegraph code element 1(A) or 1(B) if within 5 years prior to the receipt of his application by the Commission he held a commercial radiotelegraph operator license or permit issued by the Federal Communications Commission. An applicant for an amateur extra class license will be given credit for the telegraph code element 1(C) if he holds a valid first class commercial radiotelegraph operator license or permit issued by the Federal Communications Commission or holds any commercial radiotelegraph operator license or permit issued by the Federal Communications Commission containing an aircraft radiotelegraph endorsement.

(c) An applicant for the Amateur Extra Class operator license will be given credit for examination elements 1(C), 4(A), and 4(B), if he so requests and submits evidence of having held a valid amateur radio station or operator license issued by any agency of the U.S. Government during or prior to April 1917, and qualifies for or currently holds a valid amateur operator license of the General or Advanced Class.

(d) An applicant for the amateur extra class operator license will be given credit for examination element 1(C) if he so requests and submits evidence of having held the amateur extra first class license, having continuously held its successor license. An applicant should present his proof in advance of the desired examination time to the Chief, Amateur and Citizens Division, Washington, D.C. 20554 and receive a letter of certification for presentation to the field office where the examination will be taken. No code credit will be given without the letter of certification.

(e) No examination credit, except as herein provided, shall be allowed on the basis of holding or having held any amateur or commercial operator license.

[§ 97.25(b) *amended,* **(d)** *redes. as* **(e)** *and new* **(d)** *added eff. 10-27-72; VI(72)-1***]**

§ 97.27 Availability of Conditional Class license examinations.

The examinations for Conditional Class will be available only under one or more of the following conditions:

(a) If the applicant's actual residence and proposed amateur station location are more than 175 miles airline distance from the nearest location at which examinations are conducted by an authorized Commission employee or representative at intervals of not more than 6 months for amateur operator license.

(b) If the applicant is shown by physician's certificate to be unable to appear for examination because of protracted disability.

(c) If the applicant is shown by certificate of the commanding officer to be in the armed forces of the United States at an Army, Navy, Air Force, or Coast Guard station and, for that reason, to be unable to appear for examination at the time and place designated by the Commission.

(d) If the applicant demonstrates by sufficient evidence that his temporary residence is for a continuous period of at least 12 months outside the continental limits of the United States, its territories or possessions, irrespective of other provisions of this section.

§ 97.28 Mail examinations for disabled applicants for Amateur Extra and Advanced Class licenses.

(a) The Commission may permit the examination for an Amateur Extra or Advanced Class license to be administered by a volunteer examiner selected by the applicant when it is shown by a physician's certificate that the applicant is unable to appear for a Commission supervised examination because of protracted disability.

(b) The volunteer examiner for an Amateur Extra or Advanced Class license examination shall be at least 21 years of age and shall be the holder of a class of amateur operator license equal to or higher than the class of license for which the applicant is being examined. The written portion of the examination shall be obtained, supervised, and submitted in accordance with the procedures set forth in § 97.29(b).

(To be continued next month)

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

HELP WANTED – Assistant Circulation Manager for 73 Magazine, male or female. Must be fluent in English, have proficiency in reading/writing Spanish, and have typing ability. Prefer ham or previous ham, domestic or foreign. Send resume c/o Circulation Manager, 73 Magazine, Peterborough NH 03458.

JACKSONVILLE, ILLINOIS Area Hamfest, July 8. Morgan County Fairgrounds, rain or shine. Tickets $1.50 or 4 for $5.00. WB9CEB, Box 571, Jacksonville, Illinois 62650.

WANTED: OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner W7FIZ, 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

SSTV ROBOT CAMERA OWNERS – NOW available a vidicon carriage kit for micro photography to take pictures as small as a postage stamp. INSTALL IT YOURSELF, $12.00 prepaid anywhere in U.S.A. Write to K8NTE, BOB PINDER, 1277 Cricklewood S.W., Wyoming, Michigan 49509.

WILL PAY $4.00 each for magnetic tapes for IBM MT/ST· Selectric Composer. Must be in top condition. Box UN11M, 73 Magazine, Peterborough NH 03458.

GLOBAL RESEARCH & Supplies. Amateur Equipment & Service. Dycomm, Galaxy, Tempo, Kenwood, Inoue, B&W, SBE, Hy-Gain, Cush-Craft, Larsen. 312/2794658. P.O. Box 271, Lombard, Ill., 60148.

VACUUM MOLDING BUSINESS for sale, complete with orders. Ideal for Magnetic Plastic Signs, etc. 24" x 30" Machine & associated Equipment. $5000.00. P.O. Box HT, 73 Magazine, Peterborough NH 03458.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Hallicrafters FPM 300 SSB xcvr	$480
Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾m	$255
Digital Logiclocks	$80
Midland 13509 220 Xcvr	$200
Midland 1520 Hand-held 2 meter	$190

"DON AND BOB" guaranteed buys. Triex W-51 386.00; MW50 250.75; MW65 331.50; Ham-M 99.00; TR44 59.95; AR22R 31.95; Belden 8214 RG8 foam coax 17¢/ft; 8448 rotor cable 10¢/ft; HyGain TH6DXX 139.00; 204BA 129.00; TH3MK3 114.00; 400 rotor 179.95; Mosley CL36 149.00; CL33 124.00; TA33 114.00; MCQ3B 91.00; S402 143.00; 3/16" cable clamp 18¢; Mallory 2.5A /1000PIV epoxy diode 29¢; Polygon fiberglas spreader 7.50; KY65 code ID 5.95; write quote Midland, Regency; Clegg FM27B; Hallicrafters FPM300A; Drake, SBE, Standard, Eimac, Collins, CDE replacement parts. Shipping charges collect; warranty guaranteed. Mastercharge, BAC. Madison Electronics, 1508 McKinney, Houston, Texas 77002 (713)224-2668.

2 MTR. 8 CH. SCANNER $70; Heath Two'er $20; AX-190 80-10 Mtr. xstr. rcvr. $185; T-60 80-6M. AM/CW xmtr. $15; H. Ober, 20005 Roscoe Bl., Canoga Park CA 91306.

LAMPKIN MODEL 111 PPM Meter, mint condition, also RCA WG297 H.V. probe, first $50.00 M.O. takes both. J. Kaufman, 125 River, Alpena, Mich. 49707.

FOR SALE: COLLINS GEAR TO THE HIGHEST BIDDER, 32S3, 75S3, KWM-2A, 2-312B4, 30L1, 2 AC power supplies, in excellent condition, original owner. WA2KNC–Jack Aviv, 106 Glenn Avenue, Lakewood, NJ 08701.

DELMARVA HAMFEST August 19, 1973, Harrington Fairgrounds. Registration fee $2 advance, $3 at the gate. For information write Delmara Hamfest, Inc., Route 2, Box 90, Laurel, Delaware 19956.

CANADIANS – FREE 120 page Electronics Catalog. ETCO-B, 464 McGill, Montreal.

WARREN HAMFEST, Largest family style Hamfest in East. Sunday, August 19th, @ Famous Yankee Lake Park. Giant Fleamarket, Swimming, Picnicking – All Free. Details QSL W8VTD.

GENERAL ELECTRIC solid state Voice Commanders, 2 each with nicad packs. Excellent mechanical shape. $60 each, $110. pair; trade for 450 MHz base, repeater, or HT. John Thornton, 12585 Jones Bar Rd., Nevada City CA 95959.

TECH MANUALS for Govt surplus gear only $6.50 each: R-389/URR, R-390/URR, R-220/URR, R-274/FRR, TS-382DU/U, TT-63A/FGC, URM-25D, ALR-5, LP-5. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

MODERNIZE FOR PEANUTS! Frame & display QSL's with 20 pocket plastic holders. Two for $1.00, seven for $3.00. Prepaid, guaranteed. Universally used and approved. Order now. TEPABCO, Box 198S, Gallatin, Tennessee 37066.

6 MTR 250 WATT base station, GE Preprog too big to ship, $75.00, Foster, Box 198 Star Route, Tijeras, NM 87059 (505)281-3975.

MIX PLEASURE WITH PLEASURE. 1973 Hamburg International Hamfest on Sept. 15 only 45 minutes from fabulous Niagara Falls. RV parking for weekend only $2.50 with hook-up. Details: Valerie Orgera K2KQC, 187 Main, Hamburg, N.Y. 14075.

ROSS and WHITE or Kyokuto Denshi 2 meter FM 10 watt transceiver. Internal tone burst with 4 tones. Crystals for 52/52, 76/76, 94/94, 04/64, 16/76, 22/82, 34/94, 37/97. See 73 Magazine 4/72. $225. 8 hour battery and charger $25. Heavy duty leather case for radio and battery $15. Tiny Tone touch tone kit $30. K6ESC, 20650 Lomita, Saratoga CA 95070 408-867-3912.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Drake, Regency, Standard, Clegg, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Mosley, Ham-M, Hustler, electronic pocket calculators, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal friendly Hoosier service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812)-894-2397.

HT-220 two watt two channel with case – best offer over $75. Box 12, 73 Magazine, Peterborough NH 03458.

RESISTORS: A-B, Stackpole, most values, .¼W, 5% 5¢. Signetics N7441B $1.15. List SASE, Texas residents 5% tax. I.C.S. Company, Box 622, Bellaire, Texas 77401.

SSTV FOCUS/DEFLECTION COIL KIT for K7YZZ 1¼" Plumbicon type camera circuit (re., 73 Magazine, Sept. 72) complete with reprint article, $19.96 postpaid in U.S. and Canada. Also fast scan 1¼" coil kits as well as many other SSTV kits, parts and plans. See regular ad elsewhere in magazine. Write or phone for free catalog. ATV RESEARCH, 1301 N. Broadway, Dept. 73C, Dakota City, Nebr. 68731.

COMPLETE 36 page QSL catalog, 3rd edition. New "SPARKLING" QSLs. Hundreds of cuts, ten report forms, thirteen colored stocks, 25¢. Ten sample QSL cards. Corneilson's Quality QSLs, 321 Warren St., N. Babylon, N.Y. 11704.

WANTED-HF SSB xceiver/ac-dc p.s., 2m Fm xceiver, Ht-200 or equivalent. HAVE mint R-390/A with spares, cables, case, tech. man. etc. for trade. Make offer. T.L. Fleming (WB5DRR) Apt. "C" 5919 W. 19th St., Little Rock, Arkansas 72204.

MUST SELL for college expenses. DAVCO DR-30 high performance solid state receiver. Cost $400, asking $200. OMEGA DA full-feature IC keyer with built-in double paddle. Cost $85, asking $40. Both are in very good condition. Andrew Beary, WA3DQS, Box 526, 5115 Margaret Morrison Street, Pittsburgh, PA 15213.

GIANT N.E. CONVENTION sponsored by FEMARA Sept. 29 & 30 at Dunfey's Hyannis Resort on Cape Cod. Huge flea market, seminars, FM, SSTV, NEDXCC, AMSAT, YL trips, 2 pools, golf, beaches, sailing. Early bird registration still only $3 from W1ZQQ, 17 Barnes Avenue, E. Boston, Mass. 02128. Special early bird hotel discount available.

WANTED: Motorola HT-220. WA2FAS, 24 Gardenia Drive, Maple Shade, New Jersey 08052.

SELL: E.E. and other technical books. SASE for list. Roger A. Baim WB9BDP, 2753 W. Coyle, Chicago, Ill. 60645.

HP416A RATIOMETER $125. Gertsch RT-5R Ratiotransformer like new $100, Beckmen 7250 BR counter $35.00. Frequency Standard – late model NAVY-URQ-9, 5, 1, .001 MHz output, 110 VAC or 24 VDC emergency input. Similar in specs to a Sultzer 5 with SP supply $1000. Will consider trade for surplus video equipment. Norman Gillaspie, Box 2124, Monterey CA 93940. 1-408-375-7424.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

GLADDING 25 2M-FM transceiver. Late model with new audio, microphone. Includes AC supply. $180. WA7SJN Bill Nelson, 4414A Larch, Mountain Home AFB Idaho 83648.

90-DAY GUARANTEE on all these Fully Reconditioned receivers: Drake 2-C/2-CQS $219, Hallicrafters SX-99 $79, SX-101 $129, SX-101 Mark-3A $139, Hammarlund HQ-100 $99, HQ-100AC $129, HQ-110C $119, HQ-110AC $139, HQ-170AC $189. More arriving daily. Write: Burghardt Amateur Center, Box 73A, Watertown, S.D. 57201.

TAKE YOUR PICK from this wide selection of SSB Transceivers, all fully reconditioned with 90-day Guarantee: Drake TR-3 $369, TR-4, $419, Eico 753 with both AC/DC $159, Galaxy GT-550A/AC-400/SC-550A $499, Kenwood TS-511S/PS-511S $429, SBE SB-34 $269, Swan 175 with both AC/DC $129, 240/117AC $219, 350/117XC $249, 350C $279, 500/117XC $419, WRL Duo-Bander 84 with AC or DC $129. More arriving daily. Write: Burghardt Amateur Center, Box 73A, Watertown, S.D. 57201.

TEKTRONIX 545 'SCOPE, complete but not working, $150 or trade. Send SASE for details. 6' x 19" equipment rack, $25 or trade. Other stuff. Jim Einolf, 1222 N. Capitol Ave., Lansing, MI. 48906.

WOODSTOCK GRAVITATIONAL SOCIETY is dedicated to the encouragement of discussion and publication of serious scientific proposals concerning gravitational and related phenomena. For further information write: Woodstock Gravitational Society, 10 Hasbrouck Lane, Box 157, Woodstock, New York 12498.

WANTED: HQ-129, Sky Champion, Comet Pro, RME-69, calibrator for NC-300 – in good condition, preferably in mint condition, by cheapskate collector of historical ham gear. Why let your widow throw out that old 30's receiver – sell it to Department HQ-129, 73 Magazine, Peterborough NH 03458 for bottom dollar. Please state absolute minimum you'll take.

RECORDER, EA-AW, 115V 60HZ, input 1-MADC, manual and some accessories $70.00; Sound powered handsets, new $5.00. W1IIB, C. Wallace, 8 Elaine St., Hampton, N.H. 03842.

NAME YOUR DEAL! Following items offered either "Fully reconditioned with 90-day guarantee" or "Working condition – AS-IS (price in parenthesis): Viking II's $35($25), Viking II with 122 VFO $79($59), Valiants $99($89), Rangers $85($75), excellent Ranger II $129($119), Globe LA-1 Linear $55($45), Johnson Courier Linear $85($75), National NC-173 $59($49), Heath TX-1 $59($49), Gonset IV $99($85), Johnson 6-N2 Converter $25($20), Heath SB-10 $50($40). Write: Burghardt Amateur Center, Box 73A, Watertown, S.D. 57201.

SSTV MONITOR TUBES 5 to 12 inch P7 P14 also ok, electromagnetic and electrostatic FOCUS types. 12.50 to 28.00. 25¢ stamps for specs, prices. Other surplus. Lotz, 750 Florida Blvd., New Orleans, La. 70124.

AMATEUR EXTRAS only – Wallet size miniature of your license. Send original (which will be returned) + $3. Box 60045; Chicago, Illinois 60660.

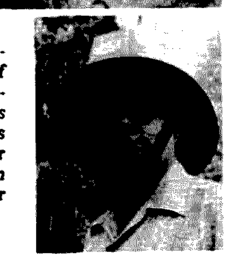
HI-FI MOTORCYCLE HELMETS Concealed speakers, left side mini jack. Complete with made up cable and plugs that fit TR-22 and most tape decks or CB's, fiberglass, most colors, gold and green flake $58.00. Amateur net $36.00 postpaid in US, Saint Communications, RR1, Box 402, Idaho Springs, Colorado 80452.

NEW PRODUCTS *(cont. from p. 20)*

associated transistor to appear on the monitor! The lines were sharp, the resistor values were absolutely readable and, Holy Moses, the idea hit us what a great way this is to trade schematics over the air . . .

Pictures were even better. Since enlargements were no longer needed for a good slow scan image, a gold mine of material opens up with every batch of snapshots from the brand X photo processor in town.

The micro photography kit is available for $12.00 postpaid from *Bob Pinder K8NTE, 1277 Cricklewood SW, Wyoming MI 49509.*



Wayne demonstrates the use of a 2m fire hat containing ISC's small modules. Is that transmitter putting out an FM signal or Alpha waves?

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bonanza trial subscription offer. If every single member of your club does not immediately sign up to become a 73 subscriber the entire editorial staff of the magazine will be so surprised and shocked that they may discontinue their lifelong membership in the ARRL. Now, you wouldn't want anything drastic like that to happen, would you?

Why take a chance?

Call your secretary and get him on the stick – accept no excuses. Let's get this show on the road.

UNUSUAL OCCUPATIONS

While out in California I met an amateur who has been working with a medical unit experimenting with pressure chambers and they had discovered that people put in an oxygen atmosphere under pressure would undergo some interesting changes – like getting younger – hair beginning to grow back on balding heads – things like that.

Since amateurs are into virtually everything that is going on scientifically, perhaps through the pages of 73 we can get some hints on interesting developments that are shaping up which we might not otherwise hear about. Unless the readers of 73 are a lot more reactionary than I give them credit for, they share my interest in new ideas – and are looking for fascinating new things to talk about on the air. How many times can you tell people you are using a dipole antenna, anyway?

Somewhere I read that an ionized atmosphere is conducive to better work and to better thinking. Some experiments had been made with having a highly charged metal sheet along the ceiling – and people didn't get tired nearly as fast. This obviously could be done with a television high voltage supply and some aluminum foil – has anyone any data on this?

What about Kirilian photography? Has any reader experimented with this as yet? Please let us know!

I've talked with quite a few readers who have worked with orgone and orgone accumulators – so how about some data on this for us? Come on, let's get some weirdo junk into 73 for a change (will that be a change?) – and let's try to make it far out enough so that W5 down there will be so dumbfounded he will make the first contact of his life without telling what rig he is using.

BIG AND LITTLE HAND UNITS

There is no question that the Motorola HTs are beautfiful gadgets. They are small – light – and rugged. But they are more geared to the commercial market than the hams by virtue of their small size.

The slightly larger hand units such as the Standard 146A and the Ken KP-202 use small parts, but not *extremely* small parts. The cost difference is substantial both for original manufacture and for replacement. Those micro parts are expensive to buy and incredibly difficult to change, thus making the larger hand units much less expensive to make and to service.

The initial expense of the HTs has been kept down by Motorola units which were rejected from commercial applications being made available to ham builders for repairs – but this doesn't help on later repairs as much.

OCEANUS

Ace Goodwin W1GRO, our circulation manager, keeps his eyes open for new ideas and it was he who called the existence of Oceanus to my attention. In an article in Yankee magazine – a magazine published in the next town to Peterborough – the concept of a new country, belonging to all mankind, and dedicated to the protection and development of the oceans of the world, was revealed.

The "territory" of Oceanus consists of all of the seas of the world beyond the three mile limit from the land countries. Thus Oceanus is by far the largest country in area in the world – many times over. The constitution of Oceanus is quite parallel to that of the United States and the idea is that it will be governed by the nations of the world for the benefit of all mankind, rather than by a small group for their own profit.

My attention was first attracted by the idea of a new country. You know what happens to a DXer when you wave even the possibility of a new country at him. And you may have a faint idea of what happens to a DXpeditioner when you even hint at a brand new country for him to operate from!

Once my attention had been attained, I got to thinking about the idea of Oceanus. I got to thinking that somehow over the centuries the governments of the world have looked upon the oceans as not being territory and thus not being owned by anyone or any government. There have been some problems raised due to fishing rights, radio broadcasting, and things like that – but the idea of the oceans of the world being territory doesn't seem to have evolved.

Obviously this idea of the oceans as non-territory is about to break down. More and more use is being made of the seas and the land under them. We already have offshore oil drilling over three miles out. And with the techniques of undersea exploration expanding rapidly, the day when we have undersea mines, gardens, and perhaps fish ranches is within grasp of the imagination.

We can all wait for the biggest nations of the world to start claiming the oceans – five miles – fifty miles – 200 miles – 2000 miles. The wealth of the oceans is beyond estimation so there will be quite a fight. It would seem obvious that the smaller nations of the world would lose out and the bigger nations would become bigger – and exploitation would be the name of the game.

Thus the idea of setting up the oceans of the world as a new country, run by the nations of the world, seemed like an idea that had arrived at the right time. The initial work to be done by the new nation would be to start cleaning up pollution and preventing it in every way possible.

My first move was to get in touch with Admiral Welles, the chief executive of Oceanus, at the home base of Oceanus in Manset, Maine. We talked on the phone a couple of times and then got together for a long talk and brainstorming session.

The basic problem with establishing a new country such as this is in getting it recognized. Obviously the U.S. is going to be extremely reluctant to recognize Oceanus since such a recognition would tend to diminish the possible future claims of the country for large areas of the oceans. Since the smaller countries of the world and, in particular, the land-locked countries have the most to gain from getting a piece of the oceans – or at least in making sure that the oceans don't just go outright to the big nations – these countries will be approached first.

Another tack which could help to establish the validity of the country would be via the United Nations. The virtual control of the U.N. by a handful of large nations means that Oceanus wouldn't have a prayer by a frontal approach. But how about through the ITU section of the UN? Suppose we first set up Oceanus as a separate country with a radio prefix which is registered with the ITU? The ITU naturally will not want to extend recognition to a country that is not otherwise recognized; yet on the other hand they are most anxious to keep radio call prefixes under control and registered according to their system.

We shall see. One of the first moves I made was to send a letter to the ITU on behalf of Oceanus telling them that the government of Oceanus would like to issue call letters in the block O1AA to O0ZZ. This series has not yet been

allocated as far as I know. The calls would be used only within the limits of Oceanus aboard vessels of Oceanus registry. It was proposed that the ITU zone numbers would be added after the call letters of the station as an indication of the area of Oceanus within which the station was being operated.

Oceanus has been set up in such a way that the citizens of any country of the world may apply for dual citizenship. Citizenship in Oceanus will in no way affect citizenship in the U.S. or any other country. Vessels may be registered with Oceanus and still keep their registry anywhere else.

Along the same line it is proposed to issue amateur radio licenses valid for operation in Oceanus on Oceanus registered vessels to amateurs of any country. There will be no licenses issued to anyone not holding a valid amateur license in another country.

As far as I know there is no precedent of U.S. citizens establishing a brand new country, so the government agencies of the U.S. don't know just how to deal with the problem. They can't go by the rule book when there are no rules.

In order to get started on the recognition of Oceanus Admiral Welles has appointed me as Chancellor of Telecommunications. The FCC has already warned me that as the representative of a foreign government they may have to take away my ham ticket – and while I don't want to lose that, that certainly would be a recognition of Oceanus. It's a merry-go-round. If they refuse to accept Oceanus then they can't harass me – if they do get after me then they have granted official status to Oceanus. Perhaps, so to speak, I can push the car from the running board to get it started and then jump off when it gets going.

Once in motion, Oceanus should move along briskly. What with small taxes on users of the country such as ships and cables – fines for ecological despoilers – licenses for developers, it could be quite a thing in 20 years.

COLLINS COMEBACK?

Collins is again beginning to think in terms of a reactivated amateur sales effort. An official of Collins recently explained that engineers and technicians had, on several occasions, gotten new ham products ready for production, only to have the plans cancelled by erstwhile prexy Art Collins.

The S-line and KWM gear are still popular, despite the design being the oldest on the market today. The reliability built into Collins equipment cannot be denied – it runs through thick and thin – and is ideal for expeditions where reliability is the key factor.

The recent reports of Collins making deals in Japan for production of ham gear in that country have been confirmed, though the plans are apparently to produce it only for sale in Japan, and not for export to the U.S.

The financial traumas of a couple of years have been eased and Collins stock has been gradually gaining ground. It dropped from about $115 a share in 1967 to about 10% of that figure – and is now back up to around $25 a share. There is still a lot of debt, but the present management has set a good record and the prospects are bright.

ONE MEG

Some scoundrel has been whispering that Wayne Green is trying to change repeaters to one meg spacing. Utter rot and baloney. Wayne Green honestly doesn't give a damn whether repeaters are 600, 601, 990, 1 meg or 1200 kHz.

It is a fact that I do feel that everyone should have his day in court, and that extends to the one meggers as well as the conservatives who are fundamentally opposed to any and all change.

In reviewing the situation nationwide, there appears to be some patterns emerging. I think that, if we are going to be honest, we have to agree that there are some parts of the country that have different problems to face than others. Amateurs in the mountainous and hilly areas find simplex virtually useless and FM operation in these places has tended to emphasize repeaters. Amateurs in flat land have developed much more simplex and the number of simplex channels in use in these areas is a function of the number of active FMers. This holds particularly true for the larger urban areas, most of which are in flat country. If you are going to get picky with me over this, let me explain that Los Angeles is truly flat land, but with some mountains to hold up repeaters and remote base stations, just as New York has tall buildings for the same purpose.

With 14 repeater channels in the 146 MHz segment of the band and 13 more channels in the 147 MHz segment, all but the most densely populated areas have enough channels to serve them. In fact, only in the Los Angeles and New York areas has any great problem arisen as far as needing more than the 27 FM repeater channels. Thus, the one meg problem would seem to be a matter of interest only to amateurs in those two areas and be of no more than academic interest to the rest of us fortunate enough not to live in the giant beehives.

Frankly I see no need to think about or discuss the one meg situation outside of those two cities. I think we may see a lot more one meg activity in those cities if the repeater groups in those areas do not head off the problem by getti together. In fact, Los Angeles has gotten together and no one meg talk has ensued – which might be a rather broad hint to the New York repeater groups.

FM and repeaters has developed oddly in New York. We have the phenomenon of one giant repeater, a few medium size repeater groups, and a host of splinter groups. The move of WR2AAA to a one meg split may change his pattern – and it would certainly appear that any change would be for the better. If WA2SUR/WR2AAA were to get many more users the timer would have to be put back to 15 seconds and the slight shreds of human conversation that occasionally have been emerging from it would be stilled.

If all the Greater New York groups can suffer the ego deflation of getting together on a regular basis to hash out their problems, it is possible that a lot of the frustration and resentment which has been building could be cooled. We might find that some redistribution of activity could be made so that all of the 27 repeater channels could be used by a little bit more equally sized groups. Should seven fellows be able to hold a public repeater channel for themselves in New York? Should a small group in one part of the city be able to set up on a channel and demand that everyone else keep off?

Now that 220 is beginning to open – with good inexpensive gear and even repeaters coming available – it is possible that the New York repeater groups might interest some smaller groups that just don't want anyone else to talk with them to open up their 2m channels and move to 220.

If the New York repeater groups ever did get together the way the Southern California groups did, they might be able tp consolidate and arrange things so some or even all of the splinter channel repeaters could find a home on one of the standard 27 public channels.

It is always possible that a study of the simplex channels – there are 13 of them in the 146–148 MHz segments – would show that there are more than are needed and that some one meg or 990 MHz repeaters could be set up to use a few of these channels. Hopefully this extreme ac-

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W2NSD/1 *(continued from p. 105)*

tion would be taken by smaller groups rather than by bigger ones, so visiting amateurs would still be able to call in on the regular channels, and have a chance of talking with most of the FMers.

The FCC, in setting repeaters up to use the 146–148 segment of the band, apparently had in mind that most of the simplex, if not all of it, would move below 146 into the 145 MHz segment. Many amateurs feel that perhaps they know more about FM than the FCC and they are going to stick to 146.52 for the primary simplex channel. Note aside: the IC-22 transceiver received for test came through with 52/52 simplex crystals installed! Perhaps we're getting somewhere at long last.

How about it, New York?

BUSMAN'S HOLIDAY

And what does the editor of an amateur radio magazine do over a rainy weekend? What else – he hams it up.

Just before the new repeater regulations hit last October our managing editor Keith – W7DXX/1 – had the 73 Radio Club repeater hooked up so users could access 10m and work some sideband DX. Then, for reasons which are totally inscrutable, the FCC decreed that there could be no more interconnecting of 2m and 10 rigs, so the 10m link had to be disabled.

That was a pity, for the extended groundwave on 10m made it possible for amateurs almost anywhere in New England to talk over the WA1KGO 2m repeater – and vice versa. With 10m a near total disaster area due to a constipation of sun spots, the activity was a shot in the arm. And there certainly is no shortage of 2m channels in the forseeable future – so no one was being hurt and there were benefits to everyone involved.

With the new regulations you can't interconnect 2m to the lower bands, but you still can use 222 MHz and above for this devious purpose, so I set out to see what I could do along this line. By the end of the weekend I had managed to surmount an impressive number of obstacles – like connectors that look like they should work, but don't – test equipment that has to be fixed – the works. But the result was a system which permits me to talk over my low band sideband station via 444 MHz, from a hand unit or the car – and from anywhere within several miles! What a blast that is!

There are some licensing details that will have to be followed up before more people can use the system – but we'll get there. The new regs make it a lot more difficult to have fun, but it is still possible. Why the FCC should decide to throw unnecessary roadblocks up like that is anyone's guess.

Now, let's see – how can we go about changing frequency or swinging that beam via the link? Hmmm.

TIMING OUT

One of the unfortunate aspects of FM repeaters is the inexorable time out feature. Sure, there are times of the day when this is necessary to keep one long-winded chap from driving a multitude of mobile ops up the wall with frustration. But there are also times of the day – or night – when it doesn't make a darned bit of difference if someone starts talking about something of interest instead of merely affirming the fact that some sort of tenuous contact is indeed possible.

Now, to make this even worse, the accursed time out feature, an invention of commercial FM repeaters which was set up as protection against a faulty repeater and not as a limitation on rag chewing, since such is not normally a part of that service, has been brought into amateur radio by the commercial two-way ops who did most of the groundwork on ham rapeaters – and right on into the new regulations, where it is just as unneeded as many other of the ridiculous limitations that have been put upon us.

Put it this way: why must a repeater in Sitka, Alaska time out a rag chewer at 4 a.m. after three minutes? This is what the rules have made into law. For that matter, why should a repeater in mid-Manhattan be forced to shut down after three minutes at 4 a.m.?

The fact is that repeaters which are heavily used have, for the most part, installed timers to keep transmissions short. Repeaters which are rarely used have, for the most part, ignored timers since they are of absolutely no value to them. Isn't this a more reasonable approach than a blanket law which applies to every repeater all the time?

One aspect of FM repeater operation that turns off a lot of operators is the lack of meaningful conversations. I'll grant that these are difficult to come by on the low bands too, but at least there you can talk for a while when you get into something you enjoy and you don't find that you timed out somewhere in the middle of the conversation.

Timers do a lot to enforce non-contact type of contacts. These are the contacts where nothing whatever is exchanged other than the information that a contact has been made. Try and explain the fun of that to your non-ham friends and see if you can do it without their becoming incredulous and thinking that you must be complete idiot.

You will probably have to explain quickly that this fantastic communication system is not a total waste of time and money – it does occasionally function in the public interest for reporting accidents or dry gas tanks of hams who have been paying more attention to "monitoring" the channel than to their cars. It does sound nice and official – and important – to announce that W2NSD/1 is monitoring the channel. Big deal.

It is probably unfair to make anyone feel guilty for spending their amateur radio life in the pursuit of communicationless communications via FM repeaters when we have those vast hordes of DXers looking for pileups for the purpose of a signal report and a QSL. More communicationless communications.

Here we are with one of the best communications systems in the world – a means whereby people can talk directly with people anywhere in the world – and we hardly ever use it for communications at all.

Put that in your damned timer and smoke it.

SELECTIVE CALLING

While the fishing expedition of most blind calls is fun – you never know who will answer your CQ on the low bands – or the equivalent of a CQ on FM – there must be something to be said for being able to get in touch with one specific friend when you want to.

A selective calling system could be made to work – within limits – on the lower bands. Interference and skip conditions might make most systems a lot less than dependable, but then this is amateur radio, not commercial and we are in it for the fun involved, so most of us can probably accept less than perfection.

On FM and via repeaters a calling system could be quite dependable. I'd like to see some articles on simple calling systems for use with FM. There are enough small manufacturers around looking for likely products so I think that any relatively simple system might be attractive enough for them to build with a royalty arrangement to the inventor.

While some of us are able to work with a repeater monitor going constantly in the background, I think that most of us can't. I know that I would like to have some sort of calling system so my friends could alert me that they wanted to talk with me via

one or more repeaters — some system which would not depend upon my having to monitor or on the chance that I might happen to call in at the same time as my friend happened to be listening.

A two tone system is probably simple enough for both encoding and decoding to work successfully. All we need is the hardware design and we might get the idea off the ground.

The "go" signal could turn on the speaker — or ring my chimes — or, in the car, sound the horn.

How about it?

WHAT ABOUT PRIVATE REPEATERS?

The small groups that operate private repeaters have problems, no doubt about it. For the most part they try to keep their channels quiet, but as more and more Clegg 27B's proliferate, secrecy is difficult to maintain. The Comcraft transceivers are even worse, for they tune the whole band, and they tune it with one flip of the wrist. It takes a bit of doing to scan the whole two megs with the Clegg and this could preserve very small repeater groups from widespread detection.

Once a public repeater comes on the private repeater channel, there is little the private group can do but shrug resignedly and look for some other open pair. The number of crystals involved can be substantial — particularly if, as is usually the case, the principles of the operation are heavily into Motorola gear. You don't buy those crystals for $3.75. By the time you've bought crystals for a couple of mobile rigs, a couple of base stations, and a couple of hand units, you have run up a big bill. Well, perhaps that is the price of snobbery and exclusivity, and it should be taken in stride.

In areas where there are free repeater channels, the privates can move — but what about New York, where everything is full? Should the private group fight to hold a public channel for their restricted use — or should they bow to numbers and move on up to 220?

Some groups are apparently thinking of going the route of the remote base, where all members of the group are listed as remote operators. This would have the advantage of the group being able to move entirely out of the repeater band and down below 146.0 MHz. If they were all General or above in license, they could even use the 144—145 MHz segment of the band, which has faded away in most areas of the country to almost total disuse.

WHO'S WHO

The recent glut of controversial regulations wafting to us from the FCC has raised tempers and resentment. It has also cause no little frustration. We've been thinking in terms of the amateur division of the FCC as being the last word — and now that the last word is unacceptable to a lot of people, the question arises, where do we turn next?

The next step is the Chairman of the FCC, Dean Burch. Unfortunately this apparently is an illusory next step, for letters sent to Mr. Burch end up right back on the desk in the amateur division, with no hunt that Mr. Bruch has even seen them. This is obviously no good.

Well, since writing to Chairman Burch is a dead end, let's look up the ladder a bit more and see who is there. The FCC is managed by the Communications Unit of the Commerce Committee of the Senate. This is the committee that does the hiring and firing. Let's take a look at this committee and see if we have some help available from there.

Warren I. Magnuson (D-Wash.) is the Chairman of the Commerce Committee. Amateurs in Washington could do a lot worse than write or call Senator Magnuson and express their views of what has happened to the FCC amateur division.

Senator John O. Pastore (D-RI) is the Chairman of the Communications Unit and directs the activities of the radio industry in the U.S. Rhose Island amateurs please take note!

Possibly the one key man for us all is Senator Howard Baker Jr. (Tenn.) who runs the amateur and CB division of the FCC. Tennessee amateurs should certainly let their man know what they think of the recent turn of FCC events. The rest of us can drop Senator Baker a letter and explain our problems to him and ask for his help. We can also ask our own senators to call Senator Baker and pass along our hopes that there will be some substantial changes in the FCC amateur division which will result in an increase in sensitivity to our needs.

You might scour the bands for Tennessee stations and, when you find them, impress on them the importance of their sitting right down and writing to Senator Baker.

Ten Tec is in Tennessee and if you happen to be in touch with them you might suggest that as an important manufacturer in Senator Baker's state, they get in touch with the senator and impress on him that many amateurs feel that the FCC amateur division no longer has respect for amateurs and that this could lead to another CB-type situation if continued.

NEW FCC COMMISSIONER

The single, sole, only Commissioner to sign the perfidious repeater docket — in my estimation the most destructive piece of FCC rulemaking in the history of amateur radio — will be replaced this month by a new man. Nicholas Johnson, an LBJ appointee to the Commission, is being replaced by David Bradshaw, a Chicago lawyer, a member of John Connally's Democrats for Nixon, and son-in-law of W. Clement Stone, one of President Nixon's most lavish campaign supporters.

Surely at least some of our readers either knows Mr. Bradshaw or knows someone who knows him well enough to get some word to him of the desperate plight of amateur radio. I will fly anywhere any time to explain what has happened and the disastrous results which are coming from it to an FCC Commissioner or a member of the senate committee running the FCC.

EVERETT NEW ASSISTANT CHIEF

Richard H. Everett, who has been a legal advisor for the amateur and CB section of the FCC, has been named Assistant Chief of the Amateur and Citizens Division. Dick has been with the Commission since 1956, when he joined it as a Law Enforcement Officer. He moved to the amateur section in 1963.

QSL CONTEST

73 is offering fame, and a hint of fortune, to the winners of the monthly QSL contest. The winners will be selected every month on the basis of the attractiveness and unusualness of the cards. Get those neurones popping out there and come up with some different QSL's.

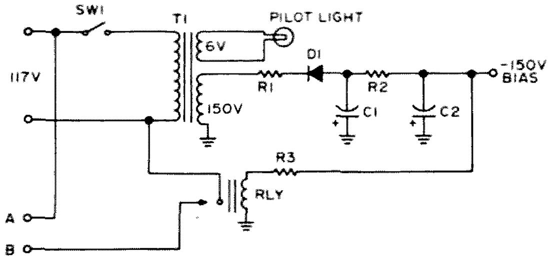
CLICHE CONTEST

Our shut-in readers are requested to take pad and pencil in hand, and start tuning the ham bands, making note of every ham cliche they hear. Let's make this art form legitimate by listing all of the most trite phrases in 73. Send your lists to *Trite, 73 Magazine, Peterborough NH 03458.*

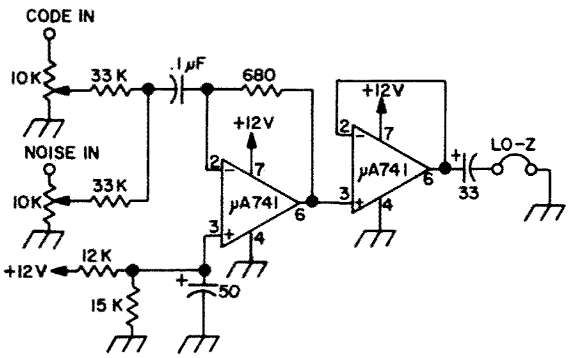
Ops out of hearing range of KGQ-1979, the CB-type repeater near Newington, Connecticut, may be able to get a very complete list of the most timeworn and sickening of old ham expressions by asking the next Connecticut low band station he contacts to rebroadcast KGQ-1979 for a few minutes. You'll hear the real McCoy!

. . .Wayne

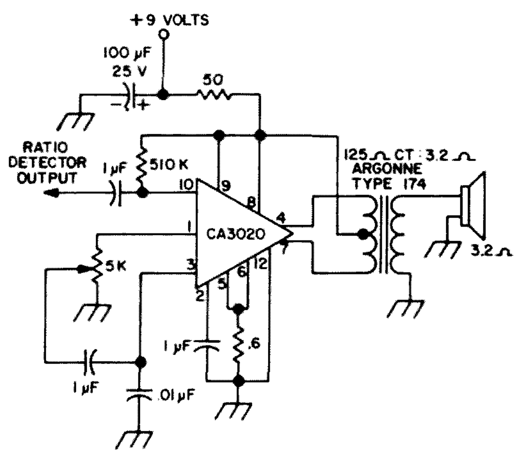
A FEW CIRCUITS . . .



A protection circuit that will turn off the high voltage power supply in a linear amplifier when bias voltage fails. D1, 400 piv ½A; R1, 10Ω 1W; R2, 1K 2W; R3 depends on relay voltage; C1 and C2, 4 μF 200V. Points A + B go to the 117V primary of the high voltage transformer. The relay should have adequate contact ratings to handle the transformer current.



A code practice audio mixer. Feed code into one input and random CW noise from the Novice bands into the other while adjusting the controls for a realistic sound.



A simple audio amplifier that is suitable for a compact FM receiver. It can also be built entirely self-contained in a minibox with speaker and battery for experimental purposes. From RCA Linear Integrated Circuits manual.

PHASE LOCK

73 MAGAZINE · AMATEUR RADIO · STAFF · READERS

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General interest articles	☐	☐
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J.H. Nelson

Good (Open) Fair (☐) Poor (O)

June 1973

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A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 magazine

for radio amateurs

$1.00
July 1973
26009

INSIDE THE WALKERGATE!

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K1CLL REINVENTS THE VFO!

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W6AGX EXPOSES CW PLOTS!

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73 magazine

for radio amateurs

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COVER: **Walker-Gate** */'wo-kar 'gāt/* **intransigent noun 1: a miniscule opening in the paperwork wall thrown up by A. Prose Walker to thwart repeater groups from providing lifesaving service throughout the country. Cover photo is of Walker telling Rochester hamfest banquet that amateur radio is, in his estimation, of little worth today. Hail to our Chief!**

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A. Entire contents copyright 1973 by 73 Inc., Peterborough NH 03458. Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.

Amateur Radio

JULY MCMLXXIII — Monthly Ham

WEATHER WATCH

The Ft. Worth Chapter of the Texas VHF-FM Society (amateur radio club) has operational in the Ft. Worth-Dallas area a network of approximately 200 trained weather observers. These amateur radio operators have attended the Skywarn spotters schools presented by the Ft. Worth-Tarrant County Office of Civil Defense and the Ft. Worth Office of the National Weather Service. After training is completed these radio operators are equipped with knowledge of weather situations that allow them to relay reliable information to the National Weather Service. They act as the "eyes" for this agency. When the National Weather Service issues a severe weather bulletin the Skywarn network is alerted and goes into operation under the Radio Amateur Civil Emergency Service (RACES) rules of the FCC. These alerts are keyed to the weather bulletin with a "Green Alert" for severe weather watch, a "Yellow Alert" for a severe weather warning and a "Red Alert" for a severe weather condition existing in the Ft. Worth-Dallas metropolitan area. Reporting for this network is accomlished via the WA5YTM repeater that is located on the KWXI-KTVT (standby) 1000 foot tower just north of the Ft. Worth terminal of the turnpike. The first hand weather information is relayed to the weather service through the amateur station located in the Emergency Operating Center at the Civil Defense Office. The volunteer amateurs, after receiving weather training, offer a highly sophisticated and reliable network of both communications and weather observers.

Alan Shawsmith VK4SS is an OT Brasspounder who collects Morse Keys – any type, age or condition, hand, 'bug,' novelty, etc. He is pictured here holding a miniature which is not a toy but a complete key used by the military. Alan's collection dates back 100 years and includes vintage overland telegraph 'pumps,' an assortment of 'bugs,' one or two novelties and a variety of keys used in the military services. VK4SS is an ex-PMG employer (B'casting pre-war 2). He has also been a ham for over 35 years and during this time pounded a variety of brass. He is keen to hear from anyone with a similar interest and to add to his collection, and will swap or buy anything in keys – ancient or modern, homebrew or commercial. Please write to 35 Whynot St., West End, Brisbane, Qld. 4101 Australia.

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

CANADIAN RTTY NET

The Canadian Amateur Radio Teletype Group has inaugurated a national RTTY traffic net and bulletin service.

Operating on 14.08 MHz every Sunday at 1930 GMT with VE5KE as net control station, the CARTG will not only pass traffic but has received DOC permission to broadcast bulletins.

News Pages

FLOOD ASSISTANCE

The Moncton Transcript, Moncton, N.B. May 5, 1973. During the last weekend in April, two eastern New Brunswick amateurs spent 36 hours in the Fredericton area aiding armed forces personnel in rescuing people and livestock from the rapidly rising Saint John River.

They were among dozens of other hams from all over New Brunswick and Nova Scotia who participated in the coordination of rescue efforts through the use of mobile, portable and station radio equipment.

Early Sunday morning, Ron Hesler VE1SH, learned there was an urgent need for hand-held 2m transceivers in the stricken area.

He immediately volunteered his services and equipment. Getting in touch with Norman Roach VE1ACA in Moncton through the repeater VE1RPT of the Maritime VHF Association, Mr. Hesler arranged with him the organization of personnel and equipment in Moncton.

Mr. Hesler then immediately departed with his equipment for Moncton, where he picked up Reed Park VE1NU Moncton, on the Trans-Canada highway. Among the equipment procured by Mr. Roach for the trip were portable transceivers owned by Ray Hickey VE1SL; George Battis VE1AOH; and Bill Horton VE1WU.

Hesler and Park arrived in Frederickton in the latter part of Sunday afternoon.

As soon as they arrived, the two men were pressed into service as a communications link between relief boats and barges and the base station VE1AVA at the Emergency Measures Organization field headquarters, and they remained on the job throughout that night and the following day.

Liaison communications back to Moncton for relief operators, equipment and welfare messages were relayed to Mr. Roach through the amateur station of Al Breen VE1ANW, located on Mount Champlain.

Ron Hesler and Reed Park remained at their assigned posts with less than two hours sleep until late Monday afternoon, when they were relieved by two Moncton amateurs, Gary Capson VE1AHM and Don Comeau VE1WT, who arrived with three additional portable transceivers. Later that night, Fred Stevens VE1DK from Truro arrived with yet another portable transceiver.

Ron Hesler, Reed Park and Norman Roach were only three of the hundreds of volunteers who spent hours and even days without sleep, food or shelter to help those affected by the rising waters.

CB News

The FCC issued the following news release dated May 4, 1973:

In an 11-count indictment returned today by a Federal Grand Jury at Detroit, Mich., George Bennett of Detroit and the United CB'ers of America, a Michigan non-profit corporation of which Bennett is President, were charged with violating various provisions of the U.S. Code by distributing counterfeit radio station licenses purportedly issued by the Federal Communications Commission.

Additionally, the defendants are charged with making false statements to the FCC in an application for a license in the Citizens Radio Service.

The indictment further charges the defendants with a scheme intended to defraud members of the public and the Government of the United States. The indictment further alleged that the defendants' activities had interfered with and impeded the lawful regulatory functions of the Federal Communications Commission.

Bennett and the United CB'ers of America were also charged with violation of the mail fraud statute and conspiracy. Named as co-conspirators, but not as defendants, were: Art Dupon, Lucille F. Mancinelli, Anthony R. Mancinelli, Joseph Goletz, Thomas Walton, Elmina C. Bennett, Joseph Smartt, Daniel DeLao, Mary Jean Hess, Ana P. Smith, Jerry C. Hopsen, A.B. Cole, Rosetta Aman, and Lohman Ballard.

By ARRL

REGS CALLED ASININE

Lew McCoy of the ARRL HQ Staff spoke up at the Dayton Hamvention to call the latest FCC regulations on repeaters "asinine." He further noted that as far as the ARRL can see we are only at the beginning of the troubles we will experience with destructive regulations.

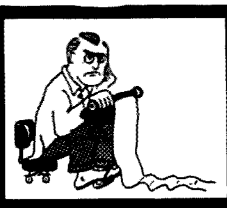
The latest FCC pronouncements would seem to back up this evaluation

The recent virtual elimination of remote base operation and the limiting of control operators to six per repeater are just two more unbelievable jokes added to the others – all in bad taste.

This application of incredibly bad rules has not only hit the repeater groups. The phone ops got just as much of a jolt to their hopes for an orderly development when the recent new phone band allocations were announced – ditto the Novices. And so it goes, with each new regulation offending and damaging a new bunch of amateurs.

The troubles seem to stem entirely from A. Prose Walker, the Chief of the Citizens Band and Amateur Division of the FCC. There is more than one amateur who wishes that Mr. Walker would devote even a small part of his time to giving the CBers as much "progress" as he has the hams. With a little of his expert attention they would soon be off the air.

The motto sprang up at Dayton almost spontaneously among the over 500 repeater ops present at the FM meeting – "Prose Goes." McCoy indicated that the ARRL is doing everything in its power to see that Prose gets ousted.



NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

WALKER SPEAKS

The guest speaker at the Rochester Hamfest this year was A. Prose Walker, the chief of the citizens and amateur division of the FCC. Walker spoke before a full house at the hamfest banquet.

Walker had quite a lot to say to the crowded room full of amateurs. He explained that in his view amateur radio was no longer justifying itself – that appliance operators seemed to be in the overwhelming majority and that amateurs no longer were making significant contributions technically and that in the eyes of the Commission there was some question about the value of the amateur service.

He read off parts of the FCC rules pertaining to the reasons for amateur radio existing and indicated that in his opinion – and probably also in the opinion of the FCC commissioners – amateurs were not shaping up and we'd better do something about it.

Walker went on to extol the merits of the citizens band – and to point out the extreme difficulties they have to work under with only 22 channels for over 800,000 licensees and some 4,000,000 base and mobile stations licensed. A tear dropped down each amateur cheek – partly for the poor CBers and partly for Walker and his concern.

Walker pointed out that these chaps have over one billion dollars invested in their equipment.

How I would love to get Mr. Walker on a platform in a debate. I am sure that many amateurs sat there and listened with increasing fury to find that the top man in the Commission is so opinionated – and so terribly wrong! This is the man who has the ear of the seven Commissioners! Apparently this is the ONLY man who has their ear, for when you write to any of the Commissioners your answer comes back from Walker.

If Walker had not been too busy to attend the talk I gave earlier in the day he would have gotten some data which would have shot holes in his pet theory that amateurs are no longer making contributions technically. I cited chapter and verse on amateur development in the development of CW, of sideband, RTTY, and even FM! The involvement is deeper than most amateurs are aware – and obviously more than the Commission is aware.

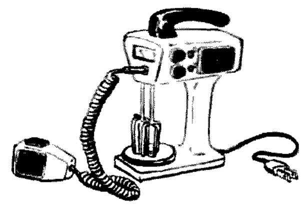
Since this was a banquet speech, no one could jump up and point out the obvious fallacies in what Walker was saying. As one fellow said after the banquet, sure there are lots of CBers crammed onto 22 channels – but this is not the same as one million hams on 22 channels on 75 meters, as suggested by Walker. When you consider that a five watt CB rig normally has a range of just a few miles, under the best of circumstances, you see that there are several thousand separate cities and towns where CB can communicate. If you figure a 20-mile range for a CB rig you end up with about 15,000 such communities around the country. Let's say that we only consider 3000 of those – 22 channels per area – and 100 users per channel (a repeater with only 100 users is occupied only a few hours a day on the average and the range is ten times that of a clear CB channel) – you find that you can handle 6.6 million CBers . . . without any need for serious interference. Of course high power, beams, excessive use, and such would eat into that number – and it has – it has.

The one billion dollar investment story seems to be Walker's answer to suggestions about eliminating 27 MHz CB. May I remind Walker that there is good and adequate precedent to make a small change in this band which could cure the problem – and not interfere with the billion investment. Remember that not long ago amateurs were forced to either upgrade their licenses or else move out of the bands they had been using – and I don't recall any concern over the amateur investment involved. General licensees were forced out of the choicest parts of the phone bands, right across the board.

Suppose the Commission decided to change 27 MHz back into an amateur band – perhaps a Novice Class band with the simple Novice technical and code exam? Upgrade or get out would be the message – just as the Commission told the amateurs. No loss in investment – even a seven year old child can get a Novice license. The one billion dollars is protected.

The manufacturers could be gotten behind this scheme by getting the power limit raised to one kilowatt – VFO operation anywhere within the band – etc. They could quickly sell another billion dollars worth of hardware.

To those few readers who tend to take all of my suggestions seriously, may I point out that sometimes I am just being sarcastic. In this case I hope that you realize the above suggestion was not seriously tendered. I don't think the FCC has the guts to make any change in 27 MHz. That's a rough bunch down there on eleven and they can set up a squawk in Washington and via the EIA lobby that the Commission will avoid at all costs. The FCC doesn't like congressmen calling up with complaints.



Now, about those appliance operators. Immediately after the Walker speech, the Rochester club gave out awards to a number of amateurs who had performed outstanding service during the recent floods – including a plaque to one of the top amateurs. Sure, we talk a lot on the air – but when we're needed we are there. A show of hands was asked for – how many here have two meter FM mobile? Over half of those present raised a hand. How many have been involved in a serious emergency in which amateur radio has helped – almost the same number of hands. A lot of us may buy rigs and spend a good part of our declining years putting out hot air on the ham bands – but most of us are right in there when we are needed – and by virtue of the equipment we use for gassing' we can do a bang-up job when the chips are down. My hand unit has only saved a life once – but how many times is enough? Even if nine out of ten hams are never needed – it still is enough.

And about that building – while not many of us build our transmitters – there are more counters and synthesizers being built in hamshacks today than transmitters in the 30's. There are more builders today – not only in number, but in percentage, if you count the innovative builders and discount the kit assemblers (which is about what building was like in the 30's – and I was there).

Continued on page 16

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

A frequently raised subject among Slow Scanners is how fairly weak signals often produce good pictures, while occasionally a picture cannot be obtained from a reasonably strong and clear signal. Reports of this have been received from all over the world, and from owners of every type of Slow Scan gear. There are two possible causes of this phenomenon. The first and most common is sync cancellation due to multipath propagation. If the two signals received at your QTH (two instead of one due to the multipath propagation) are out of phase, they will cancel. Further, if this multipath "loss" is only around 1200 Hz, only sync pulses will be lost (thus no picture), but the signal will still sound like a good Slow Scan signal. Should you look at the signal right out of the receiver's i-f with a spectrum analyzer, you could see the sync is nonexistent. There is no simple solution to multipath lost sync. Fortunately, however, the problem is not encountered too often; thus we can live with it (also, later in the sunspot cycle it will be less noticeable).

The second cause is limiter "latch up." Most solid state monitors use either a 709 or 741 op-amp in their "front end" in a limiter configuration. Should latch up occur, no output will be obtained from this stage. The solution is simple: Drop the Slow Scan input level to the monitor, the limiter operates again, and the picture appears (assuming latch up is the problem – remember, multipath propagation is the more likely cause).

Word is just in from Franta OK1OO, who writes the SSTV column for *Amateurski Radio*, that 40 or 50 Czechoslovakian hams are building monitors, and about 10 are already listening and watching. We should be hearing quite a bit from them in the near future. Also, they are quite interested in the direct fast to slow scan conversion technique, probably due to the scarcity of plumbicons there. Their monitor circuits are very modern and elaborate. For example, phase locked loop IC and magnetically deflected electrostatically focused CRT are becoming common.

Wayne W2NSD/1 recently brought up an idea which could further Slow Scan popularity worldwide if successfully initiated. He suggests starting some tape services to help chaps with only monitors to get on the air. Robot proved this point a while back, when they made tapes for new monitor owners. The results proved successful, as most of these fellows now have their own Slow Scan picture generating gear. How about some taping volunteers? If you would like to help, let me know (and whether or not you plan to charge for the "tape service" . . . although I will not mention exact prices). I will run a SSTV tape service list in 73 if this pans out.

This year's Dayton blast was the greatest yet. W4TB introduced his "Trix Box," which is capable of numerous low Scan special effects including special "wipes," video inversion on every other line, mixing black and white lettering on white and black backgrounds, "checkerboard" effects, etc. Although Bob Suding WØLMD couldn't make it, he sent a wealth of handout information on his projects. These included a SSTV sync generator with a frame time elapse readout and automatic tape recorder start/stop control, quite a few thoughts on Scan conversion (both fast to Slow and Slow to fast) plus info on his direct Fast to Slow Scan converter, (that proverbial "black box" . . . in goes a fast Scan TV signal and out comes a Slow Scan TV signal), plasma panels – replace your CRT with these 1/4 million neon bulb panels for a "super picture" – a SSTV keyboard for typing messages across the screen, and much more.

Cop McDonald presented a superb program on using Slow Scan communications as a modern bridge over (our world's) troubled waters – truly meaningful communication rather than just as an expensive toy. Ralph Taggart displayed his monitor (article on it coming up in 73) which, with the flip of a switch also displays a video analysis of the received signal. Very nice! Don Miller had his Slow to Fast scan converter (its heart is a single ended storage vidicon) feeding a regular television, and K4JPE brought a storage tube monitor.

Naturally all the Slow Scan manufacturers were there with their new gear . . . Fast scan monitors, nice cabinets, low light cameras, etc. I will go into detail on all the previously mentioned items within the next few months.

However, one item of immediate concern is STTV frequencies. In order to alleviate the present crowding on 20 meters, plans were made to move the Slow Scan net to 14.240 kHz. This should give more room (even ±10 kHz of 14.240 is better than everyone congregating on just 14.230) plus less QRM. Also, remember Slow Scan activity is not confined to only specific frequencies . . . it can be run anywhere in the Advanced class bands (80 – 15 meters). Let's get away from the .230 syndrome and start occupying the .230 to .250 region . . . and for Pete's sake, don't QRM the net! Move off frequency! It's legal. When will the net change occur? Maybe by mid-July, depending on worldwide notification. If you don't hear the net on .230 next time, check .240 (and this column next month). Also, many of the fellows, especially the west coast, are having problems with the trash on 40 meters, thus a new frequency of 7171 kHz has been chosen. Let's see more use of this choice band, especially now while the sunspot cycle is against us. Remember, we can use 7150 to 7225 kHz for Slow Scan, so don't just sit on 7171 and wait for a clear frequency.

K4TWJ

AMSAT NEWS

OSCAR 6

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Orbit	Date (July)	Time (GMT)	Longitude of Eq. Crossing °W
3235	1	0036.9	56.6
3248	2	0131.8	70.4
3260	3	0031.7	55.4
3273	4	0126.7	69.1
3285	5	0026.6	54.1
3298	6	0121.5	67.8
3310	7	0021.5	67.8
3323	8	0116.4	66.5
3335	9	0016.9	51.5
3348	10	0111.3	65.2
3360	11	0011.2	50.2
3373	12	0106.1	64.0
3385	13	0006.0	48.9
3398	14	0101.0	62.7
3410	15	0000.9	47.7
3423	16	0055.8	61.4
3436	17	0150.8	75.1
3448	18	0060.7	60.1
3461	19	0145.6	73.8
3473	20	0045.6	58.8
3486	21	0140.5	72.5
3498	22	0040.4	57.5
3511	23	0135.3	71.3
3523	24	0035.3	56.2
3536	25	0130.2	70.0
3548	26	0030.1	55.0
3561	27	0125.1	68.7
3573	28	0025.0	53.7
3586	29	0119.9	67.4
3598	30	0019.9	52.4
3611	31	0114.8	66.1

The really new item is that the OSCAR 6 schedule has finally been stabilized. The new schedule will allow enough air time to be useful and it will allow time for the onboard batteries to recharge.

OSCAR 6 ON-TIMES

Thursday	0000–2359 GMT
Saturday	0000–2359 GMT
Monday	0000–2359 GMT

On all other days the satellite will be off the air for regular traffic. Should you hear the satellite, please do not try to use it. Members of AMSAT are conducting tests and gathering telemetry for future use in trying to determine exactly what the overheating problem is. Certain stations have been designated as "Satellite Official Bulletin Stations," one of these being W3TMZ. Their purpose is to tell anyone trying to use the satellite on its off times of the new schedule and to ask them to please leave the air.

The satellite appears to be stabilizing with regard to battery drain and high temperatures that have been experienced recently. The new schedule is designed to provide a more lasting charge to the batteries and prevent them from discharging until they are dangerously low.

OSCAR 6 Telemetry Data

Chan.	Parameter	Unit
1A	Total Array	I (mA)
1B	+X Solar Panel	I (mA)
1C	-X Solar Panel	I (mA)
1D	+Y Solar Panel	I (mA)
2A	-Y Solar Panel	I (mA)
2B	+Z Solar Panel	I (mA)
2C	-Z Solar Panel	I (mA)
2D	Bat. Charge or Discharge	I (mA)
3A	Unregulated Bus	V
3B	½ Battery	V
3C	Switching Reg.	V
3D	Battery Temp.	°C
4A	Baseplate Temp.	°C
4B	Transponder P.A. Temp	°C
4C	+X Panel Temp.	°C
4D	+Y Panel Temp.	°C
5A	+Z Panel Temp.	°C
5B	Transp. P.A. Emitter	I (mA)
5C	Transp. Sw. Reg.	V
5D	Instr. Sw. Reg.	I (mA)
6A	Transponder rf Power	mW
6B	Beacon rf Power (435.1 MHz)	mW
6C	Transponder agc	V
6D	Midrange Cal.	V

From the net on Monday nights at 9:00 EDT, I have learned of the forming of a much-needed western net. Amateurs in New Mexico and surrounding states have had problems hearing the net and I hope that those who have the information and the capabilities will mold one together.

Included is a partial chart of OSCAR 6 telemetry. Stations that have telemetry-gathering capabilities please send your reports to AMSAT Telemetry Dept., P.O. Box 27, Washington DC 20044. Many stations are needed to help with this. If you have the capabilities or would like to try, send a letter to me along with SASE and I will send you complete information.

Next month I will present a special section on OSCAR mobiling and plans for OSCAR 7.

. . .WB8LBP

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

Jess WB4ZUO would like to let everyone know he will be monitoring 50.150 SSB from 2300 to 2330Z on a daily basis. I am sure Jess would also be happy to make schedules – you may write him at Route #2, West Green, Georgia 31567.

I attended the Dayton Hamvention and the associated technical seminars. The VHF seminar featured K2TXB, DL3WR, DJØBQ/G3JVQ and W8KPY. While not strictly a 6 meter affair, it was interesting, informative and a most pleasant way of meeting a number of you. There were several pieces of new 6 meter gear on display. Regency was showing the HR-6 FM transceiver; Genave, not to be outdone, was showing their new GTX-600, and Linear Systems featured the new SB-50 AM and SSB transceiver.

Happened across several of the 6 meter crowd on the display floor – Wayne K8LEE was there as was Bob WA8PEB. Met WB8JHT at the flea market and saw Frank K9HMB in the Imperial House. *73* was represented by Wayne and Keith . . . hope to see you there next year.

Didn't attend the West Coast VHF/UHF Conference? Here are some of the things we missed: Power transistors for VHF/UHF – W6FIG, Solid State Receivers – W6FZJ, 50 MHz Propagation – W6ABN, EME (50 MHz) – W7FN. Sorry I couldn't make it.

Art WA1EXN comments that the April 1st aurora started around 1800 in Maine and lasted about 4½ hours. Contacts were made as far south as N.C. (K4LWZ) and audio quality was excellent with signals ranging from 5/5 to 10/9. Over the period mentioned the band was open to the 2nd, 3rd, 4th, 8th and 9th call areas. Art worked K8BBN for the first time on April 8th – they had been trying to make a CW scatter contact all winter. Maine had its first Es opening of the year on April 20th with 20/9 signals from Georgia, Alabama and Florida. As is usual for early season openings, not many stations were active.

Art passes along a hint which is sure to be of interest to the many owners of Heath SB series gear: "Many operators have had problems with the alc refusing to work or working only intermittently . . . on investigation I found that the pot used to control the voltage for alc action had three short bronze pieces eyeletted to the aluminum connectors for ease of soldering the pot to the circuit board. When the two dissimilar metals are placed in contact with each other, oxidation occurs to such proportions as to cause intermittent alc action. This can be circumvented by bridging solder across the dissimilar metals or by substituting a good grade encapsulated pot in the board from the top for ease of adjustment. I passed this to W1ELP who in turn passed it to 10 operators of Heath equipment . . . of the 10, it cured 8."

As always, we need your reports of activity, your comments, answers to technical problems you have solved – and in fact anything which would be of interest to other active 6 meter amateurs. If you have a local net going, let me know. If you make an unusual contact, drop me a line – others are interested in activity in your area. If you have a question about equipment, activity, a rig problem, just ask. If I don't have the answer, someone among the readership will. If you have a TVI problem, a SASE will bring you a few hints on how to cure it, along with a list of manufacturers who provide high pass filters free or for a token sum.

How would you like a new all solid state station running 120W PEP output and available NOW from commercial sources? Details next month. Also next month some very interesting comments on 6 meter activity in Australia from Geoff VK3AMK.

. . .WAØABI

KQR DMQOU UKDU WTUPUPQZ,

RKTZ PF IQOY BSOM FTZGPZJ

PU?

DX FOOTNOTES

BY: Gus M. Browning, W4BPD
Drawer "DX"
Cordova, S.C. 29039

I wonder how many of you have ever been to the Dayton (Ohio) Hamvention ? This year it was the biggest ever, so they told me. The attendance was something around 6,400 and I can tell you that when you get that many hams together, you have the darndest time, shaking hands, slapping backs, yelling, Hello Ole Buddy, and an awful lot of other shenanigans. Peggy and I drove our Mustang to the Hamvention loaded up to the brim with printed matter, QSL samples, etc. Everything we brought with us was all given out in the first 4 hours Saturday morning. We could have passed out well over twice that many without any trouble. I tried to visit every display and spent well over two hours and only got to see about half of them. Wayne Green was as busy as a cat on a tin roof selling 73 magazines like they were going out of style ! At the price he was selling subscriptions (only $ 3.00) may have had something to do with the mad rush of business at the 73 magazine booth. Wayne looked like a Harvard professor with those reading glasses (the upper part missing). There was so many DX'ers there that you couldn't stir them with a stick ! The DX forum room was full of them. Stu Meyer, W2GHK did a very good job acting as MC for the entire forum. Two of the gang that went to Spratley Island were there with some very fine pictures of the entire trip. Sure did make my feet itch seeing them and their troubles getting there (3 trials, the last one a success.) The only thing on the island (before they got there) was a few million birds and so they say, the birds did a little "dumping", I suppose the birds didn't like intruders on their private island. It's a pity we cant hire these birds to do the same to intruders on our ham bands ! Also present was the fellows that went to Juan Fernandez, St Felix and a few other islands. Many fine pictures and even movies was shown, all very interesting and making a fellow (like me) want to be on the other end of a big "pile-up" again, the sooner the better. A lot of talk about maybe another big DX organization being formed one of these days, with by-laws that would make the books wide open to everyone, all the time, maybe some kind of an award for working "DX", etc. You may (or may not) hear more about this as things progress or again all the talk may be "day-dreams" by a few fellows that is hoping to put some new life blood in the art of DXing. Lets all hope for the best, because if its good for DX, its good for all of us. At the present time there are too many right up to the top in the DXCC and I guess we need something more or less new to get everyone again interested in DXing. Lets wait and see what develops (if anything at all.)

So far our 73-73-73 certificate has been earned by the following fellows: (in the order as listed):

No. 1	W4NJF
No. 2	ZM1AMN
No. 3	W5NQR
No. 4	K4CKA
No. 5	W2GA
No. 6	WB6JQP
No. 7	ZM1AMM
No. 8	K2HWF
No. 9	K6ILM
No. 10	W2PMK
No. 11	K4TWJ
No. 12	PAØALO
No. 13	ZL2GJ
No. 14	VK6CH
No. 15	WA8UUY
No. 16	W8JFD
No. 17	W5BPT/3
No. 18	DK1YG
No. 19	W3JZJ/8
No. 20	WA2EJS
No. 21	5W1AU
No. 22	VK2BJL
No. 23	WBØHPL

This is not too bad, but we have a number of certificates on hand that we will mail out to those of you who qualify by having worked 73 countries in the first 73 days of 1973. Send me a list, showing the stations you worked, the country, etc. Have your list certified by 3 hams or your clubs secretary. KEEP IN MIND this is a ONE TIME CERTIFICATE, you get it now or you NEVER GET IT. Please send along $ 1.00 to partly cover our costs and I will do the rest. All WTW (Worked The World) certificates will have been mailed a month or so before you are reading this. The backlog of certificates work has now been caught up and I am QRX for anyone who has worked their 100 or more countries. We need a copy of your countries alphabetically arranged BY PREFIXES, showing dates, bands, mode used and name of country, also certified as above along with the $ 1.00. DO NOT SEND ME YOUR CARDS if you can have them certified. Your QSL cards should be on hand for this one and they should be certified. MOUNT ATHOS: I hope those of you who needed this NEW ONE had a QSO with the recent DXpedition to this spot. I had a number of fellows complaining that they never had a chance to work them due to what SEEMED to be caused by lack of activity. This seems hard to believe when you consider that TEN fellows was on the DXpedition to this rare country. I can assure you, that as far as I know this has not ever happened to me when I was on the other end on a DXpedition, and I AM ONLY ONE PERSON, without 9 others to "assist" me ! I am not saying who is at fault, I only pass on what was told to me. I wonder what some of you "out there" think about this ?

Please keep me in mind when you come across any DX news that I can use, but keep in mind that I have 60+ days date line. I need particularly news of any upcoming events,most certainly news of any DXpedition planned somewhat in the future and I always need news that is not "dated" Naturally I can always use your comments and suggestions to improve this column in this magazine, as long as they are of interest to other DXers.

QSL INFO:

1S1A - (Spratley Island via W1YRC
SV1DB/A - Mt. Athos via
SV1DB - Constantine Psiloyannes,
P.O. Box 1442, Athens, Greece
YK1OK: via Jenda Bubenicek
Box 35, Damascus, Syria

HB - Switzerland, worlds highest DX percentage country ! Thats right, according to a note I received from HB9J which says: If you will add up all the countries they have worked and divide this number by the number of hams in Switzerland you will have a higher number than any country in the world. I have took the word of HB9J that this is true, but it would be interesting to see some actual numbers to be 100% convinced. hi.

If you really want to work a LOT of countries try this: When you have received a card from any certain country DO NOT EVER WORK THAT COUNTRY AGAIN. Use your time LISTENING FOR NEW COUNTRIES. If nothing new is on spend that time LISTENING AND LISTENING !

A FEW DXING SUGGESTIONS:

1. Do not ever call the DX station on the exact frequency the last station was on if its a split frequency deal, remember that *many, many* other stations are doing the same thing.
2. Make your calls short, he knows his call GIVE HIM YOURS. be sure you use STANDARD PHONETICS.
3. Obey HIS INSTRUCTIONS, he is running the show NOT YOU.
4. Listen for a while and see how he SEEMS to be tuning, and select a frequency YOU THINK he will be tuning to. (Out guess the gang on this.)
5. DO NOT start anything like rag-chewing, giving your "handle", or QTH, etc. NOT UNLESS he indicates that this is what he wants from you.

DO NOT BE A DX HOG !

73 es DX, de Gus W4BPD

A. PROSE WALKER

An Appreciation

by Keith Lamonica W7DXX/1

Although I am not from Missouri I do like to give people the benefit of the doubt. As you may know I have been active on FM for many years. In fact, I put up one of the first repeaters when that era was just starting. I enjoy VHF, FM and repeaters. I enjoy the challenge of experimentation in one of the newest areas of our hobby. Oh, I like operating 20 CW and Slow Scan but the potential of VHF repeaters excites me. I get a little bored on the lower bands – not so on VHF. There are still so many areas of experimentation.

I remember well two meters prior to Docket 18803. We were having a few growing pains, but on the whole the situation was not bad at all. What problems we were having were being ironed out quite nicely by individual repeater owners or repeater councils. As I recall, most of us were simply asking for FCC recognition of FM, the clarification of certain FCC rules and the implementation of a few new regulations to cover these areas of repeater operation where there were no rules. As you remember, before Docket 18803 the word "repeater" did not even show up in the rules and regulations of the Federal Communications Commission as far as the amateurs were concerned. Anyway, we all expected 18803 to provide us with some guidance in the licensing and installation of FM repeaters. Boy, were we ever wrong. Docket 18803 hit us like a rude noise in church. Docket 18803 as it stands virtually means an end to experimentation on VHF as far as repeaters are concerned. The rules are now so restrictive and so ridiculous as to make it almost impossible to get anything other than a simple (very simple) repeater licensed. Am I exaggerating? Hell, no. Those of you who live in California are well aware of the fantastic work being done in the way of repeater interlinks. It is possible to sit in downtown San Diego and talk all the way up the coast to Northern California and beyond with your walkie. What a great public service these systems are during times of emergency. What about the Chicago Repeater Group with their fine machine? The one with the several receivers and transmitters tied together with an ingenious voting system – I could go on and on describing some great achievements on FM and repeaters but suffice it to say that these achievements must now stop. There is now no way for us to build the ultimate repeater. Why? Docket 18803 and A. Prose Walker, that is why. I mentioned earlier Missouri and the fact that I have always given people the benefit of the doubt. When Docket 18803 came out I tried to steer away from the hysteria being generated by some. I hoped that the obvious faults of 18803 could be ironed out. I envisioned a modified 18803 in the near future that would echo most needs and supply us with what we needed to continue what we had started on 2 meters.

I quietly listened as A. Prose Walker told us how 18803 was the best thing that could have happened to FM. He said we should forget about the negative side of 18803 and recognize the positive side. He said we can now let a fellow from anywhere, even if he has no license, come into our shacks and operate CW. Don't ask me. I'm still trying to figure that one out. Walker told us we should consider ourselves lucky that 18803 is not more restrictive. He told us that we should appreciate the fact that we have our own common carrier systems in the ham bands with which we can link up to telephone lines for autopatch. In the same breath he told us we will probably lose our autopatch privileges because some people are abusing them.

Walker spent a great deal of time telling us how ham radio has changed. He accused us of all being a bunch of appliance operators with no desire to build or experiment. In the same breath, he told us that 18803 would stand. This virtually eliminates any experimentation and building in this phase of the hobby.

We were told that if we did not like 18803 we should petition the FCC to change the rules. Next he told us that all such petitions would be rejected without consideration since the FCC a few months ago rejected – across the board – all petitions to reconsider 18803.

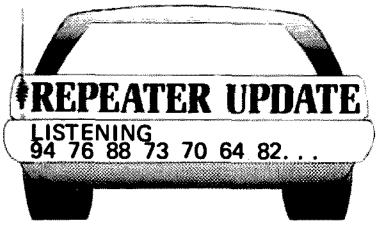
We were accused of letting the public down as far as emergency public service is concerned by not providing the communications needed. But he rejected the idea presented by one individual that repeaters should be able to interlink to provide emergency communications. After the Walker circus had been in progress for 55 minutes, I was actually getting a little sick to my stomach. Walker was threatening us. He told us that we had better shape up or things might get worse. Actually, what Walker was saying to the many repeater owners and users present was, *Tough – this is the way I* (Walker) *want it . . . this is the way it is going to be and there is not one damn thing you can do about it.*

Walker was scheduled to speak for one hour. Everyone expected a question-and-answer period would be most fruitful. However, Walker kept looking at his watch to make sure his talk lasted the full hour and that there would be no time for questions. Due to a mistake on his part, there were about five minutes left after his talk for questions. A few questions were put to Walker. The first: "Mr. Walker, don't you think it unreasonable that one individual can shut down a repeater by simply talking on the output of the machine? Is it not possible for someone with a personal gripe to make it rough for hundreds of repeater users?" To this Walker said no one has an exclusive right to a frequency. The fellow on the output has asmuch right to be there as the hundreds of repeater users. In other words,Walker opened the door to those very few who can now delight in shutting down all the repeatersthey want, simply by calling "CQ" on a repeater output frequency. Another fellow asked Walker why 18803 is so restrictive. Walker had no good answer other than to imply that if we don't like it, tough! It could be worse. I asked Walker if there was any way amateurs could change 18803. He said sure, all you had to do was file a petition. I said, "Did you not say a few minutes ago that you had considered all there was to be considered and that you will reject all petitions for reconsideration?" He said that they had considered all there was to be considered and that petitions for reconsideration would be returned to the sender.

All I can tell you about Walker is what I heard and saw. What I heard was the biggest pile of crock I have ever heard. What I saw, in my opinion, was an egotistical monarch delighting at the despair of the amateurs. I think Walker has a one-man, one-sided idea of what he thinks ham radio is all about and that nothing short of getting him fired is going to save our hobby as we know it. Don't think for one minute that Walker will stop with 18803. He will not.

Those of you who were at Rochester now know A. Prose Walker. Those of you who were not at Rochester, don't take my word for it. Ask around. Ask about A. Prose Walker. Then it is up to you – if you want to lose your hobby as we know it, fine. Just sit back and say to yourself that everything is okay. If you feel that your hobby is worth something to do, do something about it. Write your congressman, write Barry Goldwater, even write Spiro! Do something, for god's sake.

. . .W7DXX/1



CT	WA1PHX	delete	147.76–146.76
CT	WR1AAE	Litchfield	147.49–146.49
CT	WA1PXO	Roxbury	147.90–147.30
IA	WAØVVQ	Ottumwa	04–64
IL	WR9AAD	Murphysboro	25–86
MA	WR1AAC	Salem	28–88
MA	WR1AAH	Marlboro	01–61
	ex-WA1QIZ		
MI	WR8AAA	Milford	146.19–146.79
	ex-K8SWW		147.79–146.78
NC	WR4AAA	Salisbury	28–88
	ex-W4EXU		
NC	WA4BVW	Mt. Pisgah	222.46–224.06
NY	WR2AAB	Yonkers	31–91
	ex-WB28LQ		
OH		Akron	04–64
OH	W8IOO	delete	
PA		Meadville	04–64
UT	WR7AAA	Cedar City	34–94
CANADA			
NS	VE1HR	Fraser's Mountain	28–88

REPEATER APPLICATIONS

In order to build a literature of acceptable methods of getting repeater, control station and auxiliary station licenses, it would be greatly appreciated if anyone or any group managing to get a license application approved would send a copy of the application to us here at *73 Magazine.* We'll try to pass along the info we get in this way through the pages of *73* and in person at hamfests and club meetings. Eventually we may be able to put out a handbook of accepted application answers and reduce getting a license through Mr. Walker to a rubber stamp procedure.

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

This month, let's look at the two meter FM activity in and around several areas of the USA. Consider Detroit: Detroit was recently described in an article in *Time* as the Murder Capital of the United States. *Time* also reported that the majority of homicides were committed by friends or relatives of the deceased, so, if you are going to or through the Motor City, *know who your friends are.* Seriously though, Detroit is a

Due to the unbelievable slowness on the part of the FCC to issue new repeater licenses, we have been forced to begin running our Repeater Atlas Registration Form every other month.

great city in which to start a trip to Canada.

There are two repeaters in Detroit. K8VLN on 04–64 and WB8CQS on 16–76, both requiring a 100 Hz subaudible tone for access. The 04–64 repeater will only relay tranmissions accompanied by the 100 Hz tone, while the 16–76 one will relay about 3 to 5 seconds of transmission not accompanied by the tone, after having been keyed up by the tone. It is thus possible to tail-gate or work through the repeater provided someone else keeps keying it up every 3 to 5 seconds or so. The 16–76 crowd are very friendly and usually don't mind doing the necessary for transients (or others). The sub-audible tone requirements were added to the repeaters because they were experiencing interference from users of the Toledo and Cleveland (Ohio) and Sarnia (Ontario) repeaters.

WB8BDD 25–85, a carrier operated repeater in Clarkston, Michigan, about 15 miles northwest of Detroit, is workable from the Motor City. I could get into it from the second floor in northwest Detroit using TR-22 when on a recent trip. WB8CSC 37–97 is in Ann Arbor, about 35 miles southwest of the city and not too far from the airport. It has good coverage of the west side of Detroit, but you will normally need more than a TR-22 to get to it from Detroit.

Now consider a different part of the country, the southeast. WA4DGM drove from Maryland to Florida a few months ago, working two meter FM with about 25W output. While on his indirectly routed trip he was able to work through a number of repeaters. For those intending to follow in his tire tracks (in England we'd say "follow in his footsteps," but here everybody drives), here is a repeater by repeater replay of his trip.

Leaving Washington talking on WB4QFP 31–91 and WA3SFG 28–88, he drove down to Richmond, Virginia 34–94. From there he made his way along the Blue Ridge Parkway through Virginia, North Carolina and east Tennessee, working through the following repeaters whilst up in the mountains: WR4AAA 28–88 Salisbury NC, WA4NUO 34–94 Ashville and a 16–76 machine in the Ashville area, as well as a 16–76 in the Roanoke area.

From the highest point in the Smokies he worked through K4HXD 34–94 Knoxville TN and stayed with it over a long stretch of road. Continuing on the trip he worked through W4RFR 34–94 Nashville and K4IKU 34–94 Huntsville AL. For a while no repeaters were heard, until WA5ZHD 34–94 Baton Rouge and a 34–76 machine in New Orleans. There is also W5UK, a 34–94 whistle-up repeater in that city. Driving along the Gulf of Mexico, the next repeater contacted was the 34–94 machine in Mobile AL.

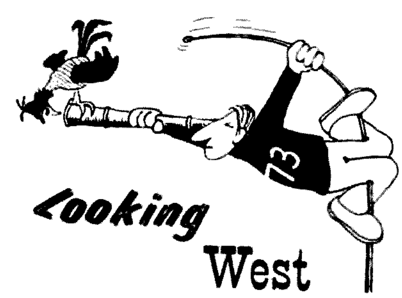
Florida was found to be full of repeaters. He found a 34–76 (PL or 1.8 kHz burst) in Fort Walton Beach near Pensacola and WB4HAE 34–76 in Tampa, which could be accessed from St. Petersburg. When he got to Miami he found WB4HAA on 34–76.

His northbound journey began at Miami. Driving up the Atlantic coast, Merrit Island provided coverage in the Cape Canaveral area. He also worked through Daytona Beach 34–94 and WB4QEL 16–76, Orlando. WB4QEL could also be accessed from the parking lot at Walt Disney World.

Driving north out of Florida nothing was heard until he came into range of the 34–94 repeater in Charleston SC, and nothing from there until Fayetteville NC 16–76.

WA4DGM pointed out that he passed through many places during normal working hours, so it is very possible some repeaters were not on the air at the time he drove through. Still, he enjoyed his trip, and if you do follow his tire tracks . . . have fun.

G3ZCZ/W3



Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

Dateline Los Angeles, May 9, 1973: Another chapter in the history of amateur FM communications was written into the books at 4:00 P.M. P.D.S.T. when the WA1KGS repeater in Waltham MA was successfully linked via telephone with the WA6TDD Mt. Wilson repeater in Los Angeles. To our knowledge this is the first time that two open repeaters separated by some 3,000 miles were

interconnected in order to give the users of both a chance to exchange calls and get to know one another.

At first it sounded like 20 meters on a Sunday afternoon, but George K1MON and Wayne K1MUC, who acted as control in Waltham, and yours truly acting as Los Angeles control, were able to improvise a system that allowed all participating stations to get in a transmission or two.Among those on hand for this event was Wayne W2NSD/1. I was personally delighted that he was involved and thankful for the encouragement he has given me in this project.

Though I have yet to go through my log tape, I can accurately estimate that in addition to Wayne, some fifty other stations participated in today's bit of ham history. To any of those who tried to get into the system and couldn't make it for one reason or another, we do apologize. This, however, is only the beginning and the future holds more. The system has been proven viable and the road is now open for others. A few years ago no one even dreamed that a two watt hand unit would span a continent. Today a ham at a restaurant in Boston using an HT can talk to a mobile on the Hollywood Freeway. Dreams do come true.

Some of the amateurs calling in on the historic roundtable were WA1QNN, WA1IML, WA1LMJ, K1ETT, W1BHD (op of WR1AAA), WA1LSD, W1YHM, WA1GXN, WA1HXZ, K1HBJ, WA6JGW, K6BWJ, W6UTE, K6LQK, K6PFW – all in addition to K1MON and K1MUC of the WA1KGS repeater, and, of course, W2NSD/1 and WA2HVK/6.

I have spent a number of spring seasons on the west coast, but by far this one is the most colorful I've seen. It's also an anniversary for us; six months in our new adopted home state. Sharon and I were discussing the past six months the other night, and we both agree we made the right move. We're happy here and are going to stay.

A recent event out here was the surprise party given by members of the Pallisades Amateur Radio Club (WB6ZDI) for one of their members who is about to be married. The lucky couple is Ward Hill WA6FUH and his soon-to-be bride, Barb Goldie. This party was the best secret ever kept among the ZDI members, and was a real surprise to Ward and Barbara. The event was held at thehome of John WA6ABW, and a quick head count revealed that some fifty people showed up to help make the evening merry. I have said before that amateur radio breeds good friendships.

While on this subject, may we also send congratulations to another newly married couplé, Warren and Lorraine Andresen, Mr. and Mrs. WA6JMM. They have just returned from their honeymoon traveling throughout Arizona, and Warren reports that most of the repeaters in the Phoenix area are back in operation. Though for obvious reasons Warren spent little time hamming this trip, he did come up with the following: Both 34/94 and 16/76 in Phoenix are back on the air, though they operate on a limited time schedule. The 16/76 channel is mainly for auto-patch use while 34/94 is the general meeting frequency. Coverage at this time is not good as it could be since these machines are located within the city on an office building rather than at their old mountaintop location. Both machines operate under the call K7VOR. Warren also tells us that there are plans for a new wide coverage mountaintop machine to be put on 04/64 in the near future. He could not get an exact date. At this time it leaves only the 450 MHz machine out of operation, and it is my hope that by the time this article reaches you, it too will be back on the air. Good luck, Phoenix.

Warren also tells us about another repeater in Arizona with near fantastic coverage. This one, K7EIK (146.16–146.76) is located in Kingman and is usable not only throughout Arizona, but as far away as Las Vegas and in parts of southeastern California as well. Sure wish I had that pair of crystals in my RCA when we were driving cross-country. That's what I call coverage. Warren says the people on this machine really went out of their way to be friendly and helpful.

WR6AAA, the Catalina repeater, is on the air and open for general use. The frequencies: 147.69 in, 147.09 out. Coverage: well, the word fantastic would be an understatement!

The new NTW 220 machine is coming along. Warren has already finished the ID unit and Bill just about has the transmitter strip ready to go. I do not know how well the other 220 machines that are being brewed up are coming along. Six meter AM and SSB has been fairly active and in tuning around the band I have located a 6 meter FM repeater. Perhaps those who own it will contact me and give me more information on it. I know it's on Mt. Wilson, but that's about all the information I have.

. . .WA2HVK/6

CONTESTS

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

Contest Calendar

July 28–30	CW County Hunters Contest
Aug. 4–5	Illinòis QSO Party
Aug. 18–19	N.J. QSO Party
Sept. 15–17	Washington State QSO Party
Sept. 29–Oct. 1	Delta QSO Party

This Month
CW County Hunters Contest

From 0000 GMT July 28 to 0600 GMT July 30, 1973. Call "CQ CH." Exchange QSO number, category (if portable or mobile. If portable send 'P' – if mobile 'M'), RST, State (or province or country) and county (if U.S. station). Stations may be worked once per band and again if the station has changed counties. Stations changing counties may repeat contacts for QSO points. QSO's with fixed stations are 1 point; QSO's with portable or mobile are 3 points. Multiply total QSO points times total of U.S. counties worked. Portables and mobiles calculate their score on the basis of total contacts within a state. Suggested frequencies are 3575,. 7055, 14070, 21070, and 28070 kHz. Appropriate trophies and certificates will be awarded. Logs must show category, date/time in GMT, station worked, exchanges, band, QSO points, location and claimed score. All entries with 100 or more QSO's must include a check sheet of counties worked or will be disqualified. Enclose a large SASE for results. Logs must be postmarked by Sept. 1, 1973 and sent to: CW County Hunters Net, c/o Jeffrey P. Bechner W9MSE, 64 North Pioneer Parkway, Fond du Lac, WI 54935.

August
Illnios QSO Party

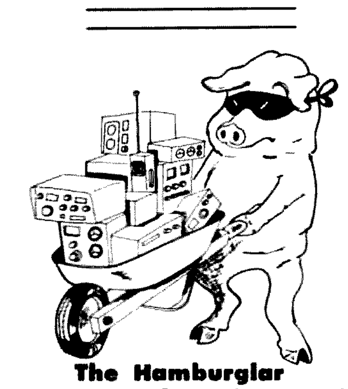
From 2000 GMT August 4 to 2400 GMT August 5, 1973. Stations may be worked once per band and mode. Illinois stations contact any station, out-of-staters work only Illinois. Score 1 point per QSO and multiply total QSO points times total Illinois counties worked. Illinois stations use total of states (including Illinois), provinces and countries (including USA) worked for their multiplier. If power input never exceeds 5 watts, multiply score by 3. Also, each group of eight contacts with the same Illinois county counts as an extra multiplier. Remember, USA, Canada, Hawaii and Alaska count again as states. Exchange QSO

number, RST, and state, province or country (county for Illinois stations). Suggested frequencies are 3560, 2725, 3900, 7060, 7125, 7260, 14060, 14275, 21060, 21110, 21360, 28060, 28160, and 28660. Phone on the hour, CW on the half hour. Appropriate awards. Logs must show date and time in GMT, stations worked, exchanges, band, mode, and claimed score. A separate summary sheet is required, showing operator's name and address in block letters, whether single or multi-op, QSO points, multipliers, and score claimed. Logs must be postmarked by Sept. 15, 1973 and sent to: Radio Amateur Megacycle Society, K9CJU, 3620 N. Oleander Ave., Chicago IL 60634. Enclose SASE for results if desired.

Not much to report this month, but this *is* the first one of 73's new regular contest column, and it does take time to get going strong. You may look forward to bigger and better columns in the months to come. As editor, I welcome any and all comments, suggestions, and questions about contests and about this column. If you have information on a particular contest, please make sure I have it at least three months prior to the date of the contest (the sooner the better, though). All correspondence should go to *my* address, which is: Tom DiBiase, 708 6th Ave., Steubenville OH 43952. With your support, this column has the potential to become the finest ham radio contest column ever to hit the pages of a magazine.

Until next month, good luck in the contest pileups!

Tom WB8KZD



The Hamburglar
STRIKES AGAIN!

Bill Grenfell W4GF is offering *a* reward for information leading to the recovery of the following equipment stolen from his car at Dayton OH on April 29th: Yaesu FT-101 s/n82G12279/CW, 1.8 MHz & CW filter installed; Regency HR-2, s/n03-02030, xtals 147.00, 146.97/94/91/76/37/34/31/12 MHz. Contact him at 7216 Valleycrest Blvd., Annandale VA 22003. Phone 704-560-5229.

A Clegg 27B, ser. no. 27013-1068 was also lost by Bob Edelman W2BXL last April 29th. His address is 408 Valley Run Dr., Cherry Hill NJ and he may be reached at 609-665-4321 during the day and 609-667-3645 at night.

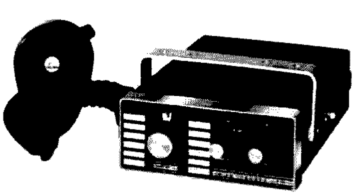
The following gear was stolen from WB2DEW's car on May 11: Standard 826MA ser. no. 208078 with P.T. mike (new style) and 11 crystals including 147.21/.210; 147.81/.210; 16/76; 147.93/.330; 147.99/.390; 25/85. The 9th position has a bad crystal socket and the channel selector dial on the number 7 position has a deep scratch on it. Johnson Messinger 111 w/mike, converted to 10 meters with 28.730 and 28.650 crystals installed. Both rigs have "Stolen from WB2DEW" engraved in many places on the chassis and circuit boards. Contact Andy Drautz WB2DEW at 4 Pine Rd., Kings Park, N.Y. 11754.

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
AF68 No. 10888	K5LKL	1/73
PMR8 No. 10918		
M1070 pwr supply		
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA6WOA	4/73
NPC 107m pwr supply		
2, 5AJ-IPL Onan Gen., No. 327885		
R4B No. 11578G	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8390		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0653556		
HR-2 No. 04-C2879	W6GSR	6/73
SB-34 No. 211828		
STD 826 No. 011288	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73

NEW PRODUCTS

HR-2B



Keeping up with the amateur tradition of technological advancement, Regency has hit the market with a third generation model of the original HR-2 – the HR-2B.

A quick look at the front panel tells the story. Aside from the more professional looking black panel, the crystal switch is now numbered consecutively from one to twelve. The old arrangement allowed only 6 crystal pairs to be installed, with 6 extra positions on the panel switch for re-pairing the same crystals. Regency has increased the number of separate receive and transmit channels to 12 for the obvious reason that most 2m activity is via standard frequency pairs through repeaters. The switch can still be wired so you can use a crystal twice, but the fact remains, the HR-2B gives you twice as many crystal sockets!

The transmit crystals used in the HR-2B are 8 MHz as opposed to the 6 MHz rocks required by its predecessors. This is a reasonable change at a time when most 2m equipment uses 8 MHz as a starting point and increases your chance of being able to walk into a radio store and find a particular crystal in stock.

The output is about the same as the HR-2A, 15–20 watts. Added, however, is the HI/LO power switch which reduces the power output to 1 watt. This feature is becoming increasingly popular with FMers because it allows a standard mobile or base station rig to double as an over-the-shoulder portable unit when connected to an external battery pack. That one watt level also lets you keep the battery size down to reasonable proportions.

The receiver is still rated at the excellent figure of 0.35 μV for 20 dB of quieting and the selectivity has been improved by the addition of a series "E" filter in the i-f for less cross-channel interference.

For a rig that has been improved and made more versatile, Regency is asking the same price . . . $229.00 – this includes the HR-2B, mike, crystals for 94–94 simplex and mobile mounting bracket.

For more information write *Regency Electronics Inc., 7900 Pendleton Pike, Indianapolis IN 46226.*

CLEGG FM-21

When the Clegg engineers sat down to design a 220 rig, they most certainly at one point went the route that is the industry standard – one crystal controlling the transmitter and another for the receiver. That the

system works well is attested by almost every commercial FM rig on the market today. In fact, on 2m, any system that does not allow independent selection of transmit and receive frequencies via separate crystals is bound to cause trouble when trying to work into oddball-paired repeaters.

At one point however, someone at Clegg with sense realized that the 220 MHz was fast becoming organized . . . everyone was agreeing on a standard 1.6 MHz spacing between the inputs and outputs of repeaters. Since a transceiver was now being designed to work within an accepted set of frequencies, the designers devised an ingenious system that sets the transmitter output on one frequency and gives you the choice of receiving on that same frequency for simplex or 1.6 MHz higher for repeater work . . . all with a single crystal! This is accomplished by judicious mixing during both modes.

On transmit, the switch selected channel crystal (45 MHz for example) is first doubled to 90 MHz. Then it is mixed with a crystal controlled 20.5 MHz signal to produce 110.5 MHz which is ready for doubling again to 221 MHz.

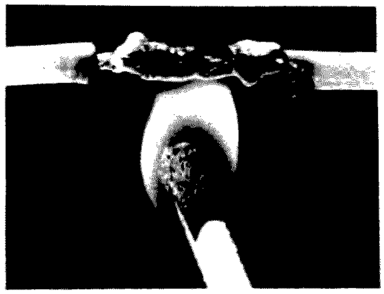
The receive process is slightly more complicated. The already doubled channel crystal frequency is doubled again to 180 MHz and injected into the first mixer. If you are working simplex, the 221 MHz received signal will be mixed with the LO signal to 41 MHz in the first mixer, and it is mixed again with a 30.3 MHz signal in the second mixer to ready it for the 10.7 i-f. If you are working in the repeat mode, the receiver will need the capability to handle a signal that is 1.6 MHz *higher*. This is accomplished by switching in a 31.9 MHz oscillator to replace that on 30.3 – thus the second mixer can now only convert a 42.6 MHz signal to 10.7. Working backward to the antenna, or adding the original LO signal of 180 MHz to 42.6, gives you the signal that will be accepted and received – 222.6 MHz, which is exactly 1.6 MHz higher than the transmit frequency of 221 MHz produced by the same 45 MHz crystal.

The receiver is rated at 0.25 μV for 12 dB SINAD with adjacent channel rejection down 50 dB at 40 kHz. The audio output is an adequate 1.5W.

The transmitter delivers 8–10W output and is protected against any rash swr changes due to forgetfulness on the part of the hand that usually screws a coax connector down tight. The supplied noise cancelling mike works in conjunction with a clipping circuit that is adjustable to provide up to 10 dB of clipping action and deviation may be set anywhere from 0 to 7 kHz.

Crystals aren't a problem as they can be ordered on a 24-hour basis from Clegg for $4.95. The unit comes ready for 6 channel operation and 5 extra channels can be added with an inexpensive conversion kit. One needn't worry whether or not 220 will remain with 1.6 MHz spacing, for the rig can be easily modified for receive/transmit channel spacings from .1 to 3 MHz. For more information, write *Clegg Division, International Signal and Control Corp., 3050 Hempland Road, Lancaster PA 17601.*

TAPE SOLDER



Ever wish you could solder a connection with a match? Now you can with Archer Tape Solder, from Radio Shack. Simply twist your wires together, wrap them with a piece of Tape Solder, and melt it with a match, candle or cigarette lighter flame. No soldering iron needed. Tape Solder seems ideal for on-the-spot wiring and repairs, slicing wire, fixing rotor cables half-way up a tower or any normal soldering job out of reach of a soldering iron. Archer Tape Solder comes in a resealable plastic pouch of 100 pre-cut pieces for 89¢.

Tape Solder is available from more than 1800 *Radio Shack* and *Allied Radio Stores* in all 50 states and Canada.

LOW PRICED DEVIATION METER

The ECM Corporation has announced a deviation meter designed especially for the ham. The ECM-5 covers all ham bands between 52 MHz and 450 MHz, and features a peak reading meter. Deviation of any FM transmitter can be accurately adjusted between 5 kHz and 25 kHz in seconds using voice or tone modulation.

The Model ECM-5 closely follows the circuits used in professional equipment except frequency selection is crystal controlled. This allows the elimination of many expensive circuits needed when frequency selection is by VFO. The net result was a tremendous reduction in price without sacrificing quality . . . $75.00 less batteries and crystals!

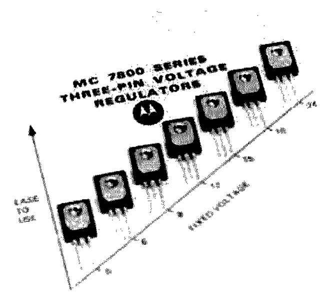
The frequency selecting crystals are the popular, subminiature type used in today's FM rigs. These crystals were chosen for their low price and availability.

The peak reading meter has a special time constant circuit that causes the needle to deflect upscale rapidly and downscale slowly. This allows the needle to follow voice peaks easily and increases the accuracy of readings when checking deviation using voice modulation.

Other features include built-in or external antenna, all solid state construction, battery powered by inexpensive AA pencells, and a battery condition indicator.

For more information, write *ECM Corporation, 412 N. Weinbach Ave., Evansville, Indiana 47711.*

NEW VOLTAGE REGULATORS



Many times the need arises for a simple, low-cost voltage regulator which can provide a moderate amount of current without complex current-boosting circuitry. The MC7805/24 series positive voltage regulators can supply in excess of 1 amp at nominal voltages of 5, 6, 8, 12, 15, 18 or 24 volts (as designated by the last two digits of the device number). However, unlike most voltage regulator ICs, these devices have only three terminals – Input, Output and Ground. They require no external components! They can be easily attached to a heat sink surface with a machine screw through the hole in the package to attain higher maximum power dissipation. The maximum input voltage is 35 volts on all types except for the MC7824 which is speced at 40 volts.

All seven members of this inexpensive regular family are presently available from warehouse stock.

For further information please contact the *Technical Information Center, Motorola Inc., Semiconductor Products Division, P.O. Box 20912, Phoenix, Arizona 85036.*

LEE SERVISET

When something goes wrong with the test setup for the 73 Crystal Bank, it has to be fixed quickly. Here's Wayne using the Lee Labs Dynamic Serviset in one of its many functions as an rf signal tracer. The Serviset has the ability to trace rf and af signals, check ac or dc voltage levels and substitute resistance and capacitance values by simply changing a test lead. It takes the place, on a basic level, of at least three or four expensive pieces of test equipment.

The unit is entirely self-contained, which means the cords that usually dangle and cause problems in most test setups are eliminated. Printed circuits are tested with ease for the main test point is long enough to get into the tight spots where a clip lead cannot go.

For more information about this versatile piece of test gear write *Lee Electronic Labs, 88 Evans Street, Watertown MA 02172.*

HAMBURGLAR HQ FOUND! W7AYQ seems to think he has found the head office in Florence, Oregon.

SOCIAL EVENTS

GI6YM AWARD

1973 is the golden jubilee of the city of Belfast YMCA Radio Club GI6YM, Northern Ireland, and the members are celebrating the occasion with a number of special activities.

This club jubilee also happily coincides with the 75th anniversary of the wireless tests carried out by Marconi and Kemp on behalf of Lloyd's, between Ballycastle (Co. Antrim) and Rathlin Island off the North Irish coast, to report ships passing the N.E. corner of Ireland.

These tests were successful and established the "first public service" of wireless in the year 1898.

To commemorate both these milestones, the Belfast YMCA Club will issue an award certificate between 1st July and 30th June, 1974.

Activity from GI6YM will be at a high level throughout the period. In conjunction with members of GI3FFF, the Ballymena Amateur Radio Club, a special station will operate from Ballycastle on all hf bands during the first week in July with the call letters GB3MKB (Marconi Kemp Ballycastle).

It is known at this point that one requirement for the award will be contact with both the YMCA Club Station (GI6YM) and the Special Activity Station at Ballycastle during the period of the town's Marconi-Kemp celebrations. This award will also be available to shortwave listeners.

HAMFESTERS

The Hamfesters 39th annual hamfest and picnic will be held Sunday, August 12, 1973, at Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, southwest of Chicago. Exhibits for OM's and XYL's, famous Swappers Row. For information contact John Raiger K9DRS, 8919 Golfview, Orland Park IL 60462. Tickets: write Joseph Poradyla WA9IWU, 5071 So. CAlifornia AVe., Chicago IL 60629.

JUNCTION, TEXAS BAR-B-Q

The third annual Amateur Radio Appreciation Day will be held in Junction, Texas July 29, 1973. This is a FREE Bar-B-Q for anyone holding an amateur license, and their family.

The day is sponsored by the Kimble County Chamber of Commerce to show its appreciation of the many public services and disaster assistance amateur radio operators provide.

For complete information contact WB5BBT, Lewis Ransom, Junction TX 76849 or the Kimble County Chamber of Commerce, 603 Main, Junction.

TWO RIVERS MEET

The Two Rivers Amateur Radio Club will conduct its ninth annual hamfest on Sunday, July 22, 1973. The event has grown to be one of the largest hamfests in Western Pennsylvania, and this year will be held at the Green Valley Fire Department grounds, off U.S. Route 30, near McKeesport, Pennsylvania. For complete details write Robert E. Zimmer WA3OGS, 205 Commonwealth Ave., West Mifflin PA 15122.

TURKEY RUN-FEST

The Wabash Valley Amateur Radio Association will hold the 27th annual VHF picnic and hamfest on Sunday, July 29, 1973, at Turkey Run State Park near Marshall, Indiana. Registration is $1.50 or 4 for $5.00, with no advance registration.There will be prizes, XYL Bingo, huge flea market and plenty of good fellowship. Talk-in is on 94/94 and 52.525 MHz.

SWAPFEST '73

The South Milwaukee ARC presents its annual hamfest on Saturday, July 14, at the VFW Post 434, 9327 Shepard Ave. in Oak Creek, Wisconsin. Admission is $1.00. There will be food and prizes available. Talk-in on 146.94.

MT. AIRY PICNIC

The Mt. Airy VHF Radio Club (Pack Rats) will hold the 18th annual family day and picnic, Sunday, August 12 (rain date August 19) at the Fort Washington State Park, Flourtown. The event features games, entertainment, and free soda. Talk-in stations will be on 50.2 MHz AM, 52.525 MHz FM, and 146.52 MHz FM.

INTERNATIONAL HAMFEST

The 10th annual international hamfest will be held July 7 and 8, 1973, at the International Peace Garden between Dunseith, North Dakota and Boissevain, Manitoba. This event has grown from a small family picnic to a gathering of radio operators and their families from California, Washington, Minnesota and Saskatchewan as well as from North Dakota and Manitoba. There will be activities, prizes and general hamfest fun. Contact Mel McKnight WAØSJB, 909 Main St., Bottineau, ND 58318 for further details.

W2NSD/1 continued from page 4

Walker came down hard on mail order licenses – saying that a high percentage were fraudulently obtained. This was a bitter pill to have to accept out there in Western New York – where a fair percentage of the amateurs present at the banquet were Conditional licensees. Obviously there is no way to know this for sure, so this is merely a matter of opinion. In talking with Walker I've found that this opinion appears to have been derived from the number of Conditional and Technician licensees who refuse to appear before an FCC examiner when called in.

As I have pointed out before, there are other possible and reasonable explanations for this and the assumption of guilt on the part of those who default is unfair. Only about 50% (tops) of the licensed amateurs are active in the hobby. Can we expect an inactive amateur to go to all the work it takes to prepare for the license exam? By the time he's gotten a book with the latest questions and answers in it and started to bone up, the date for appearing is past. Of course his decision to give up without trying could be based upon the tremendous changes in the exam since the time when he took it – which in the case of most Conditionals was many years ago. Many years. One look at the solid state questions – the RTTY questions – the sideband questions – and it's back to stamp collecting or wenching.

How many wives will be interested in the trip to the FCC office? A great many hams have coached their wives so they could pass the exams on memory alone. Naturally this short term memory material is long gone and, if the wife has to do it over, she will have to start from scratch. The answer is phooey.

The word is getting around too of the high percentage of hams who are flunking their re-exam. In some reported cases over 90% of those who did make the try to hold their license were failed. To say that amateurs, some with over twenty years of hamming – some experienced builders – are upset over being failed is a gross understatement. How would you like it?

As far as I know from talking with Walker most or all of these chaps are considered by him to be obvious cases of fraudulent licensing. Oldtimers who have even the slightest question in their mind about what Conditionals and Techs face in the present day license exam would do well to get a copy of the *73* license study course book for the General License. The book simplifies the understanding of the material – still, it is going to take some time.

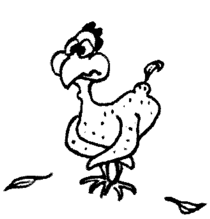
The introduction to Walker opened some eyes. FMers have been wondering what possible reason there was for all those antenna radiation patterns for the repeater antennas. The intro explained it – Walker has been working up until taking over as chief of the amateur and citizens division of the FCC making such patterns – it is a special interest of his. Now he has the amateurs over a barrel and is forcing them to provide him with data for his own pet project at the expense of the amateurs. No other explanation makes any sense.

And just in case anyone present thought that they somehow might be able to manage to live with the regulations Walker has already put out, he hinted strongly at some he has in the works – like the type acceptance of ham gear – a power/bandwidth limitation – stuff like that. Then, with a smirk, he threw down the gauntlet to the ARRL by suggesting that if we didn't like it, sue the FCC and see where that would get us.

It was a bitter pill for those gathered at Rochester for fun and camaraderie to have to sit at the banquet and listen to Walker drone on with his prepared speech for one full hour, taking amateur radio to task from every angle and then going over the talk a second time and repeating everything just to make sure the message was loud and clear. Even if the things Walker was saying were true the whole talk was in exceptionally bad taste.

Walker revealed himself to the entire group as an opinionated, closeminded cantankerous old man who, through some dreadful bureaucratic error, has been put into the worst possible job.

After the banquet the hamfest committee, despite being angry at Walker speaking for one hour when he was supposed to talk for 20 minutes, managed to spirit him quickly out of the hall past the smell of hot tar and the sound of clucking chickens.



FENCED IN

Repeater groups have run into the biggest wall of paperwork in the history of amateur radio. Attempts at penetrating the wall have been vigorously fought off by Walker with indecision and vacillation. This is most frustrating when you consider that all of the decisions have to come from Walker – he is the only gate in the wall – and he is becoming known as the Walkergate of the FCC.

The Walkergate is closed most of the time – about 95% of the repeater applications have been refused. Perhaps an investigation is in order. Many clubs are asking more and more pointed questions about the need for showings on antenna patterns – they want to know whether these are for personal private projects of Walker and whether they might be material for a book he personally has in the works. This is the first explanation that makes even a shred of sense, even though it raises serious questions of impropriety on Walker's part.

The Walkergate has closed on remote base operation as it has been developed over the years, shutting down some of the most innovative amateur work ever set up.

The Walkergate has closed on crossband repeaters – and is closing on all crossband developments – despite the hobbling effect this obviously will have on amateur ingenuity and emergency service.

The Walkergate appears to be swinging open to accept the limitation of twenty feet above existing structures for amateur towers and antennas and also appears to be opening wide for giving more channels to those poor crowded CB'ers.

TWO METERS GOING THE CB ROUTE?

The two meter repeater regulations are, to quote ARRL staffer McCoy, "asinine." The fact is that you will not find one knowledgeable FMer who does not agree with this estimation.

The result of this is that repeater councils are now thinking more and more in terms of outright violation of some of the new regulations. They protested the new rules as soon as they were announced, but Walker refused to even acknowledge the amateurs – throwing out each and every plea for reconsideration. Thus the worst regulations ever put through by the Commission were followed up by the biggest slap in the face amateurs have ever received.

Amateurs felt that this was one hell of a way to be rewarded for being the most well behaved group of licensees the FCC had. On the one hand amateurs could see the CBers running wild, with the Commission turning their face away from the mess they had generated – and even getting ready to reward this bunch of hooligans with a good part of an undeveloped amateur band – one which

is finally getting ready to be seriously used by the amateurs. On the other hand the Commission (in fact, Mr. Walker) was moving to shut down repeaters – to make remote base stations virtually impossible – stopping experimentation – discouraging invention and development of emergency services – and making life miserable with a mountain of paperwork and license fees.

LICENSING REPEATERS

As more and more repeater groups get fed up with the seemingly total insanity issuing from the FCC, and as the deadline for having a license for the repeater nears – frustration, resentment and a to-hell-with-them attitude seems to be gaining ground. They are not unaware of the annoyed arrogance reported by ARRL staffers to be the attitude of Mr. Walker.

The groups are questioning the ability of the FCC to make the ridiculous rules stick. After all, they muse, if the FCC is totally impotent in the face of the mess on the CB band – there isn't much they can do to enforce senseless rules on hams.

It is sad to see the closed-minded attitude of Walker's office turning the most behaved group of licensees the Commission has into a bunch of revolutionaries who are so furious they are considering breaking their long standing pattern of being the least trouble to the FCC of all their licensees.

THE PETITION

Many have arrived – and I need many, many more. Please make up a sheet of paper with "I petition the FCC to reconsider docket 18803" on top and have as many amateurs sign it as possible – please include their calls, addresses and zip. Send them to me . . . Wayne Green, 73 Magazine, Peterborough NH 03458.

Several readers have called to tell me that ARRL officials have been telling clubs and hamfests that the petitions are a waste of time and effort – that they will do no good. If I was not sure that they could do some good I would not go to all that work. The fact is that we have no other way to go that holds any reasonable promise of success.

Petitions to the FCC will not do any good, I suspect. Mr. Walker is too powerful there and may be able to get any and all petitions thrown out without even the slightest consideration as he did the last batch – including the hundreds of letters of protest. No, I can't see any good to come from going the "official" route.

Frankly I have never had any intention of merely filing them with the FCC so Mr. Walker could throw them down the drain with the garbage. I intend to do what I can to see if there is any possibility of getting action some other way. I want the biggest pile of petitions I can get to carry with me to Washington when I talk with as many senators as possible about the terrible situation amateur radio is in today.

If I can talk with Senator John Pastore of Rhode Island, the chairman of the Senate Communications Subcommittee and explain what the problem is – why it is important – and show him a sheaf of Rhode Island signatures, then it just might get things started. I have 48 signatures from Rhode Island so far – and I need more – lots more.

If I can talk with Senator Howard Baker of Tenessee, the man who heads up the Amateur and CB Division of the FCC – and show him names of constituents, it could help. I have only five signatures from Tennessee so far and I need more – lots more.

If I can arrange to talk with Senator Kennedy of Massachusetts and explain the ramifications of the situation, together with a bunch of signatures, he might be able to put in a word that would help to get Mr. Walker transferred. I have 37 Massachusetts signatures so far and I need many more.

I'd certainly want to see what we can do with Senator Goldwater, but with only ONE Arizona signature I don't have a very loud voice yet. Is there only one concerned amateur in all of Arizona?

Please see what you can do to get signatures on petitions. When getting non-FMers to sign, point out that the disastrous rules are hitting all aspects of the hobby, but that we are choosing this one docket to make the fight because it is so clearly detrimental to amateur radio in so many ways. If we try to fight many different dockets all at once we will lose our punch.

To date I have a little over 1000 signatures on the petition from 38 states. Michigan is leading with 257 and Ohio is second with 213 — and we nave 56 from Utah, so let's get cracking!

Put it this way — what have you to lose?

AIRBORNE REPEATERS?

While much of the country is presently served by repeaters, emergencies and disasters can strike anywhere — even where there may not be an open repeater. In the recent past amateurs have responded by going into the emergency area with a portable repeater and setting it up — this is what was done during the floods in Pennsylvania.

A faster way of getting a repeater into service where needed would be to have one that can be set up in a plane and flown around over the area needing communications. This would be able to serve a much larger area than a regular repeater — would not go off the air if power fails (as it usually does) — and could be available anywhere.

A communications system built upon an airborne repeater would be of incalculable value. The wide area it would serve would enable hand units to be used to talk with other hand units (or mobiles or base stations) over a range of two or three hundred miles, if needed.

Such a system is not likely to spring from nothing into full bloom. The fact is that though we know we can set such a thing up, there are a lot of experimental details that will have to be ironed out before it would be dependable. This means experimenting — trying it out — encouraging repeater groups around the country to set up airborne repeaters and use them. We have to find out how best to separate the transmitter and receiver so the repeater is sensitive and effective — we have to know what ranges we can depend upon from various altitudes — etc.

Keith W7DXX, the managing editor of 73, has a small Piper Cherokee plane and the interest to set up such an experimental system. We even have a nice small Standard two meter repeater (now in use as WR1AAB) which could be pressed into service to check out the idea. We're not sure whether it would work better with a small diplexer or with a trailing antenna for transmitting, getting the separation that way.

Before any experimenting can be done there is the problem of licensing the repeater — and this is such a major problem that it may be insurmountable. Keith called Walker to find out about getting the license and was advised that he would need a separate license for every call area over which he would fly. This would mean at least five licenses, minimum, for the W1-2-3-4-8 areas are all within a short flying distance of New Hampshire and

all get visited quite a bit. That's $45 in fees, plus the piles upon piles of paperwork.

The FCC is making the development of innovative systems such as this extremely difficult to set up and license. When you consider the value of an emergency repeater that is airborne, something is seriously wrong with the FCC when they interfere to that extent.

One of the basic reasons for amateur radio's existence is the development of equipment designs and techniques which will be of value and further the state of the art. The degree that Walker's regulations are making this difficult is such that the effectiveness of the amateur service is being seriously impaired.

AMATEUR RADIO HERITAGE

Present day amateurs may have forgotten some of the invaluable work of earlier amateurs. The fact is that amateurs have done a great deal of develpment of radio communications – not only in the remote past, but in the recent past.

We are all familiar with amateurs being thrown upstairs into the unwanted short waves a couple of generations ago. Okay, so be it – and we got to work and made the frequencies valuable. As we increased their value we were gradually thrown out – finally to be left with little slivers here and there.

But what have we done for radio recently? A lot – a whole lot.

Let's go back not very many years to the beginnings of sideband. How many of you know how SSB got started? You've probably heard that it was in commercial use for many years before amateurs started using it. What you may have missed is that it was in use on the low frequencies, and that until an amateur (Villard) invented the phasing type rig it wasn't practical on the high frequencies. Once amateurs got going with sideband it swept amplitude modulation right out the window. Sideband was, in all practical senses, an amateur radio invention.

How about narrow band FM? Another ham first. Jack Babkes W2GDG did the groundwork on this in the late 40's and founded Sonar Radio to build the first NBFM gear. And what are we using on two meters today? NBFM.

Have hams invented anything else? You bet – Sam Harris W1FZJ invented the parametric amlifier on six meters – and that was in the late 50's. And how about most of the present day commercial RTTY circuits – designed by hams for ham RTTY. How about slow scan television? Hams again.

Did you know that virtually all of the repeater control circuits being invented today are coming from hams? We're still at it.

But the end of the line is approaching unless there is a basic change at the FCC. The new regulations are crushingly restrictive – they thwart and prevent experimentation and development of new circuits and ideas. They discourage innovators.

THAT EXTRA CLASS LICENSE

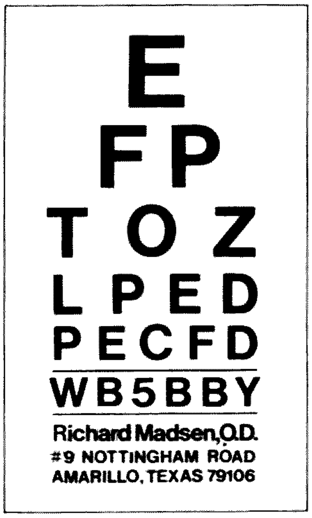
Judging from talks he has given, the Extra Class license is dear to Walker's heart and he is dedicated to its furtherance.

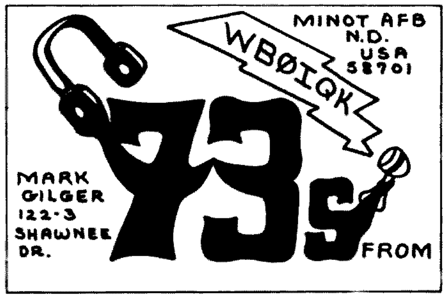
Judging from the growth curves from the FCC, amateurs could care less about the Extra.

The Extra Class license was first available in 1952 and about 4000 who had previously held the ticket were grandfathered into it. No privileges were given to licensees, so interest in it was about zilch.

The punishment licensing regulations went into effect in 1967 and this forced a few amateurs to take the Extra Class exam in order to continue to use the frequencies they had been using previously on 75m and 15m. There was a little spurt as a result of this change in band allocations. This soon settled down to a miniscule

QSL CONTEST





WB5BBY wins a one year subscription to 73 for submitting the most unusual entry this month. WBØIQK receives an honorable mention for submitting the most . . . well, how could we resist?

Send your QSL to: *QSL Contest, 73 Magazine, Peterborough NH 03458.*

growth of about **50** licenses per month – and that comes to an increase of **0.019%** (and if that isn't miniscule, what is?). That comes out to a one percent increase in about five years!

That also equals about the biggest bomb ever laid by the FCC – unless you count the recent repeater regulations, which still is unknown as to end results in number of hams forced out of the service and number of people killed by the lack of repeaters on the air to save their lives. The results of the punishment licensing bomb are now known and proven – and even the worst predictions have been exceeded by the test of time. In the face of this catastrophe will Walker continue to punish us or will reason at long last prevail and the rules be changed to benefit the amateur service instead of louse it up?

If you've invested in one of the new calculators you can have fun with those figures. You can figure out the yearly and total increases or decreases for each class of license – and overall.

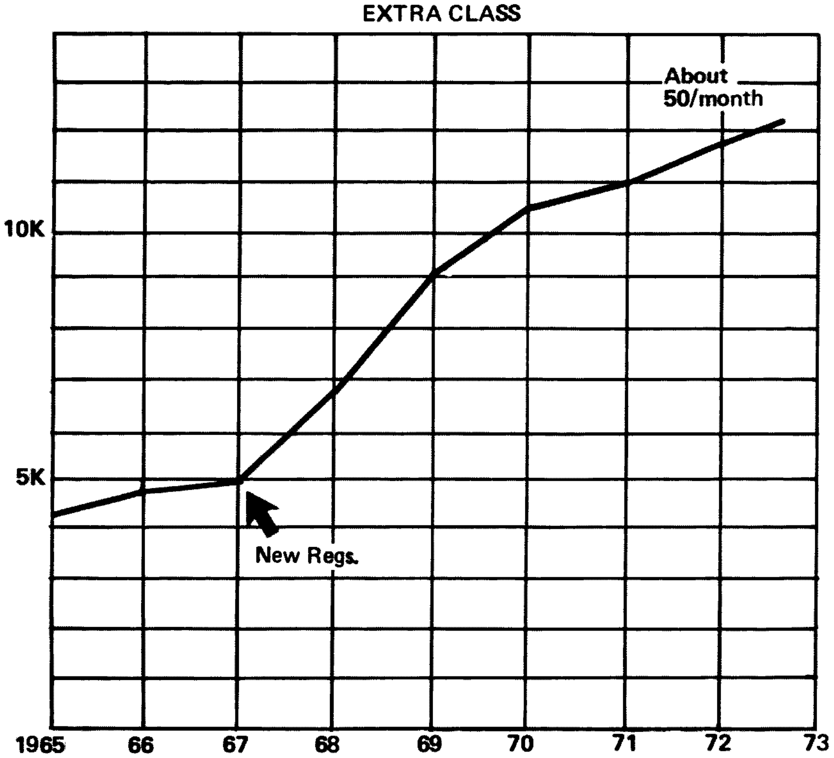
When you look closely at the Extra Class licenses you find that there has been an increase – but it is less than 3% of the ham population over a seven year period! You will also note, perhaps, that the increase was briskest about five years ago and that it has tapered off substantially to where it is going up about **1%** of the ham population in five years at present – unless it drops off even more.

Looking at the other classes of license we find that in terms of the ham population they have changed as follows: Novices are up 3.5% – Techs are down about 3% – Conditionals are down 4% – Generals are down 7.3% – Advanced are up 7.8% and Extra are up 2.9%. The total ham population has gone down by 112 in seven years.

The result of the policy of virtually eliminating all Conditional licenses which went into effect several years ago can be seen to be choking them off gradually.

The number of Advanced and Extra increases are about equal to the losses in General and Conditional. The 7.8% Advanced increase indicates that this class of license has been accepted, though not to any degree as expected by the Commission. That evens out to about 1% per year – so all we have to do is wait one hundred years, right?

EXTRA CLASS



OPEN LETTER TO DANNALS

Harry, I understand that you have been speaking at ham conventions and telling listeners that I was deceitful in getting my repeater license WR1AAB. I know that you would not dare to face me publicly with such a charge.

The license was in no way deceitfully obtained. After talking at great length with Mr. Walker I determined what I considered the simplest system for getting a repeater license. I wrote about this in the Repeater Bulletin, in 73 and I expounded on it at two FM symposiums put on by 73 Magazine and also at several hamfests and conventions. I did exactly what I recommended others do: apply for a very simple license so as to get a call and then hassle over remote control and special antennas later on.

The fact is that WR1AAB was licensed to my home in Peterborough with no remote control and with a half wave dipole. The repeater is on the air from my home under my direct control and using a half wave dipole for the transmitter, as licensed.

It is also a fact that the bulk of the repeater licenses issued by the FCC went to groups that followed the system I have propounded. I believe that WR1AAA, WR2AAA, WR3AAA, WR4AAA, and WR8AAA all used this sytem to get their calls.

Cont'd. on page 93

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

TUNABLE RECEPTION FOR TWO METER FM

The two variable oscillators described can be plugged into the crystal socket of any receiver or transceiver using 45 MHz receive crystals. The result is a highly stable tunable receiver covering the entire two meter band.

This article describes a working, tunable, IC local oscillator covering 146 to 148 MHz, that can be plugged into a crystal socket of almost any of the 2 meter FM receivers sold in the USA. You can build a few for yourself and friends, but please note that a patent has been applied for on this unit and its uses.

Design Theory and Philosophy

A lot of tunable oscillator design, including my own up to now, has suffered from precedent, habit, and a general lack of innovation. Long-time and sound consideration brings to light certain fundamental facts, as follows:

1. It is hard enough to make a simple L-C circuit stand still by itself, even without hanging a variable capacitor around it, such as a transistor.
2. To make a very good oscillator, you do not have to do that.
3. Use a basic L-C made of the best possible components, temperature wise, along with the best possible mechanical construction.
4. Use a high-gain stable, compound amplifier, one that is good to at least 50 MHz, because we are going to use it around 22 to 24 MHz, as a driver for the L-C circuit.
5. This amplifier should have a bandwidth which at least covers the frequency range we will use, in a reasonably flat fashion. This will only be some 200 kHz or less at 22.7 MHz, so it is not difficult.
6. Use the maximum gain of the amplifier, and minimum feedback to the L-C so that the L-C will control, by some 98 to 99%, the frequency of the oscillator.
7. Run the oscillator at a frequency where it will not jump around. Inasmuch as good, stable oscillators for receivers on 30 MHz have been made for at least 35 years that I know about, anything there or lower will do nicely.
8. Start off with at least a reasonably good and rigid mechanical foundation.

I bolted a thick piece of copper-clad on top of aluminum chassis. A Miller dial, slide-rule type, was bolted on top of that with heavy angles, and that did it. It tunes nicely up and down 2 meter FM sidebands, and beat a 147 MHz signal with precision. The tie points I used are my regular ones, .021 common pins, hammered into .020 holes in fiberglass strips. I actually used glass-epoxy with the copper pulled off (just because I didn't happen to have any around without the copper).

I put in a simple 6V zener to keep the voltage both down and constant. This oscil-

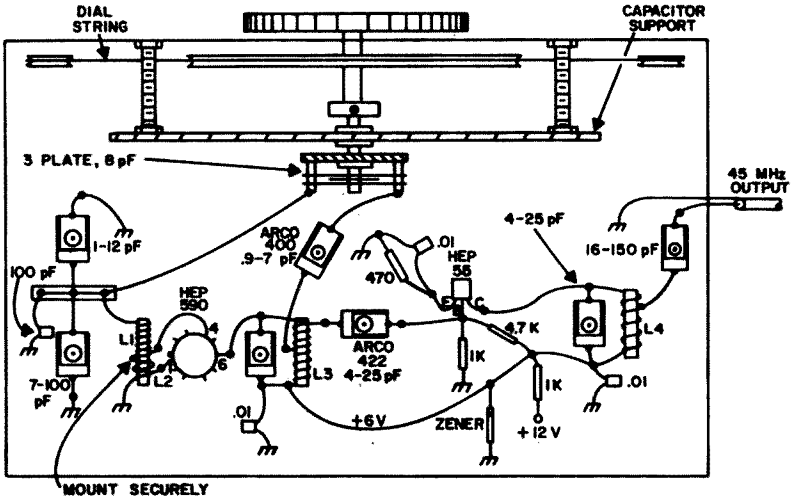


Fig. 1. Pictorial layout of the single IC plug-in local oscillator. See Figs. 2 and 5 for circuit details. This layout will lend itself to a compact construction limited only by the size of a good vernier dial.

lator is extremely unresponsive to voltage changes, but most IC amplifiers use 6V maximum and you do have to run from 12V, for car and battery operation, which may go from 11 to 15V, so at least one zener is indicated.

Couple the IC to the L-C in a manner so that the least frequency change possible will be produced. Once you have done this, and the other things mentiond above, you will have a vfo that is a pleasure to use. Mine is out in the open like all my breadboard jobs, but you can put your hand anywhere on it, except within an inch of the primary L-C, and not notice any change in frequency when listening to 2 meter FM stations. What more can you ask?

Layout

Figure 1 shows the layout used. You can put it in a small box or case if you wish, for use on top of the receiver, but better get one working first in order to have all the components tested and ready to go. Once you get them into that small case it is not so easy to modify or exchange those small units. Just be sure and observe the guidelines, and it will work for you, too. But don't leave any out!

Circuit

Please refer to Fig. 2 for the circuit. To be noted first are a number of capacitors across the L-C circuits starting with L1. C1 is operated by the dial. You have the choice of tuning over 2 MHz, 146 to 148 MHz, or using a switch and putting in two capacitors at the C3 position, one to set the receiver for 146 to 147 MHz and the other for the 147 to 148 MHz range. Of course the mixer injection is actually on 146 to 148 MHz minus the 10.7 i-f frequency. Suit yourself on the question of one or two MHz ranges. Using the whole dial for each MHz makes the tuning easier but requires a few more parts. Remember that the oscillator is actually on 22.716 for the receiver to be receiving on 147 MHz.

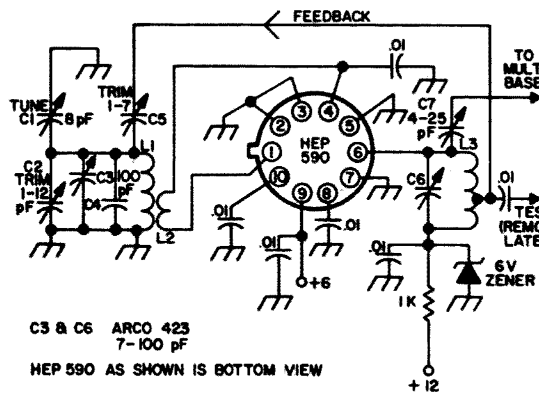


Fig. 2. Ultra stable oscillator shcematic. L1, 10T No. 24, 1.3 cm long, 0.5 cm I.D.; L2, 2T over or close to cold end of L1, coupling should be adjusted for minimum reaction while maintaining good oscillator output; L3, 13T No. 24, 1.3 cm long, 0.7 cm I.D., tap at 3T from ground end.

C2 makes it easier to set C3, which has too much capacity to set easily. It can be done, but setting the dial with C2 is better. C4 is an additional fixed capacitor to bring the C up to the desired point of bandspread so that CI will cover one MHz, with about 5% to spare on each end. I trust you are familiar with this method. The more C you put across L1, the wider on the dial is spread the one MHz you are looking for.

The tuned circuit of this oscillator is not connected to the collector or the base of a transistor. It *is* connected, via a low impedance link, to the input of an IC compound amplifier. The output of this high gain IC goes to a non-critical tuned circuit, L2, which is quite separate from the frequency determining LI. A one pF capacitor couples energy from L2 back to LI. In this manner the IC output circuit is very lightly coupled to LI. This is made possible by the high gain of the 590 IC and its very low reverse transconductance. This parameter, generally written as "Yr," is the one that in any usual bipolar transistor is high enough to cause self-oscillation unless neutralized. The different result, in a compound amplifier device such as the IC used in Fig. 1, is a very stable oscillator which handles in a superb fashion as a tunable L.O. for 2 meter FM receivers.

Details

LI is not critical. However, it should be noted that there is quite a large C and a low L. In fact the inductance of LI is so low that, if used with a low C it will tune way over 100 MHz. So we find about 200 pF across LI, which puts it into the 22 to 23 MHz region. It is then multiplied in a doubler to 45 mHz which is cabled into the receiver crystal socket. This is then used for the tunable L.O. of the receiver, which was previously crystal controlled, and becomes multiplied to 136 MHz in the receiver. With any suitable slow-motion dial, the tuning is now about as easy and non-critcal as on any band in the hf region of 2 to 30 MHz. I used a 25-year-old Bud 3 plate variable in parallel with all the other capacitors across LI, totalling around 200 pF. This produced a tuning range of a little over a MHz when multiplied by six, landing in the 135 to 136.3 range for use as a 2 meter L.O. with a 10.7 i-f frequency.

C4 should be a silvered mica or any other non-shifting-with-temperature capacitor you may favor. C3 is a trimmer for use in setting the dial for 146 to 147 MHz, the second from 147 to 148 MHz, if you use the switch method to cover the 2 MHz range. CI is the 8 pF you tune with, connected to your favorite dial. One of the nice things about this L.O. is that, taking all the items together, there isn't any one of them alone really critical. I just mounted the 8 pF on a rigid sub-panel of copper clad in back of the front panel (see Fig. 1 again), and that was it. Dividing the 1 MHz L.O. tuning range by 6 comes out around 166.5 kHz, which is all the tuning range required of the 8 pF variable at 22.7 MHz.

Internal schematic of the Motorola HEP 590, shown in Fig. 3, discloses Q1 as the common emitter amplifier driving Q2, a grounded base stage in the cascode configuration. This is called a compound amplifier. I have used the 590 for several years now, as 73 Magazine readers know, and it has always performed well. It has high gain and requires no neutralizing, due to the low reverse transconductance of the unit. That means the internal feedback is very low, even though the gain is high. Q3 is used to keep the current constant if agc is used. Agc would be applied in positive-going form to pin 5, if required, which is not the case here.

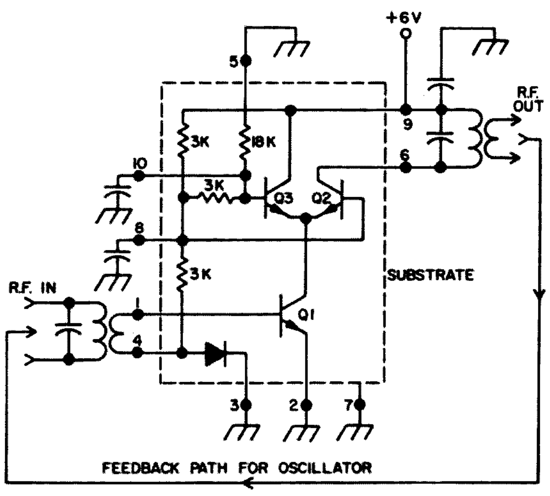


Fig. 3. Internal connections of the HEP590 and the feedback path used for oscillation.

Full gain is used by grounding pin 5. If you play around with it all, note that that pin 1 *return* must go to pin 4.

Operation

As usual, an oscillator should be running when you start to talk about it, so here we go. Referring to Fig. 2 and also to Fig. 3 for the internal workings of the 590, we see the 22.7 MHz signal entering the 590 on pin 1, the base of Q1. Here it is amplified, goes to Q2 for more amplification, emerging on pin 6, the collector, and from there on out to L3 and L6, which are also tuned to 22.7 MHz. Some 25 to 30 dB of amplification is available, and the feedback path from L3 through C5 to L1 thus takes only a small amount of the possible output power, which is not the case with many known oscillators, some of which use nearly all their entire dissipation limit just to maintain oscillation. This oscillator section, including the zener, should take about 5 to 6 mA. The value of C5 is quite important, and the needed value can be adjusted by varying the tap on L3. If C5 is connected to the high end of L3 less pF will be needed than in the indicated tap position, at 3 turns from ground. The overall phase is important of course, but shows interesting evidence of what may be called "phase-slip" as the ac around the total path C5-L1-L2-Q1-Q2-L3 and back to C5 finds plenty of places for incidental phase shift, both plus or minus. This is evidenced by the reversability of the connections to L2 without stopping oscillation. Connected in the best way, the operation is cleaner. This is not the case in most digital work where inverting and non-inverting inputs are seen to be very strict in their operation because of the dc type all-or-nothing operation.

Tune-up and Test

I used my regular tuned diode detector for this. As you go down in frequency from 147 to 22.7 MHz, these become easier to construct, as in Fig. 4. These things are of great value for crystal tune-up as well as for vfo's like this one. They can be easily calibrated with a $40 signal generator, one piece of test equipment you really should start with. There is quite a bit of adjustment to do between C4, C3 and C2, in order to

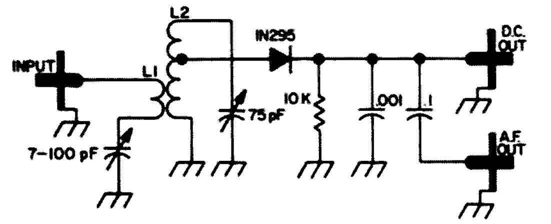


Fig. 4. Tuned diode detector (21–75 MHz) used for checking oscillator and doubler output. L1, 2T movable near L2; L2, 7T No. 3003 miniductor (16 TPI, 1.3 cm diameter), diode tap at 2T from top.

get the 1 MHz or 2 MHz spread out on the dial at 147 MHz that you are looking for. Also you may have to change L1 quite a bit. It's well worth it, though, because once you get it you can leave it, with slight touch-ups on C2.

Feedback

After a few adjustments on C5 you will soon get the hang of it. Too much feedback will cause too great a rise in milliamps in the 590. Too little feedback will result in weak oscillation. Just be sure and peak C6-L3 to the same frequency as L1. C7 will have an effect, though small, on L3, so it should be connected into the doubler which should be operating also. You can connect another tuned diode to the doubler output if you wish. I always do that, because as you jump around in frequency during the first tune-ups, you may easily hit an undesired harmonic and unknowingly stay there. The tuned diode detectors give you relative power and frequency at all times. Make sure of a good repeatable dial and mechanical stability before you start assembling and wiring.

Calibration

If you are in a region where there are plenty of repeaters, like here in Peterborough with Massachusetts, New Hampshire and Vermont mountains, and Connecticut hills, you can pick up ten or fifteen at almost any moment mornings and evenings, and will have no trouble calibrating the dial.

If not, start out with the indispensable signal generator, which should put you quite near 147 MHz, give or take half an MHz or so. You may have to find a friend who can help a little, with something on Two, and

then someone is sure to have on hand some old two meter crystals which can be put to good use to calibrate the dial, if by chance you live several hundred miles from the nearest repeater. (Just where would that be today?)

You will also want to spread 2 MHz, say 146 to 147, over the dial. This takes a little more doing, but with some frequency points found, a simple graph can be set up which will help, such as 146 = 15 on the dial, 147 = 91 on the dial, etc. At least one crystal probably came with your receiver, which will help, or you can order one on the frequency of your nearest repeater, and this crystal can be used later also.

Doubler

Most receivers use a crystal in the 45 MHz range, so you're most likely after a 45 MHz output here. There are a few receivers with 15 MHz rocks, Inoue and Standard for example, but most use 45 MHz. So a simple doubler as in Fig. 5 does the trick. An HEP 55 is used, but almost any 200 MHz NPN will do. A lead from C7 to the base of the 55 from C7 in Fig. 2 brings the 45 MHz in to the doubler. The collector goes to C1 and L1 in Fig. 5, with a tap on L1 and series C2 for the matching and loading of L1. Do not load L1 too heavily. If you use the tuned diode detector method you will be able to adjust this to the right point, which is a compromise between maximum output and maximum Q. You should be sure and have good tuning in order to boost the 45 MHz and drop the rest. Loading too much will not produce this happy condition. That's about it for the doubler. Be sure and use a diode detector to check on relative power while tuning up, and check the af to be sure noise is kept out. This doubler circuit is about as simple an rf circuit as can be found, so good luck.

Crystal Socket Adaptor

I expected complications when connecting the oscillator-doubler unit to the receiver crystal socket, such as self oscillation in the crystal transistor, with the crystal out, etc. Some did show up, but they were soon eliminated. After a few trials with tuned circuits and certain other methods,

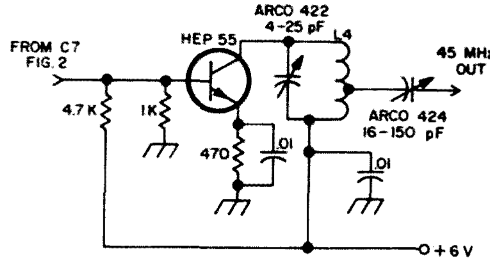


Fig. 5. Doubler for 45 MHz output. L4, 7T No. 24, 2.3 cm long, 2 cm I.D.

with self-oscillation showing up at times, I found the simplest way to do it. Figure 6 shows that (at least in this case) the simplest is the best. The two series capacitors C1 and C2 take care of any dc voltage wandering around between the units and eliminates self-oscillation in the receiver crystal circuit (from which the crystal has been removed, of course). Remember that a crystal is a "perfect" capacitor as far as dc goes, so there is no dc component to worry about. The crystal is often used as a dc blocking cap. My usual oscillators are almost always that way. Even in the good old days with tubes and a hundred volts or so, crystals were always good at blocking dc. After all, it's quartz, isn't it?

If you run the doubler output circuit C1-L1 in Fig. 5 with the cable output tap fairly high up on L1 you will get quite enough voltage at 45 MHz. The cable should then be as short as possible and run into the receiver crystal socket. I found quite a lot of leeway, with nothing critical encountered except if you get a little off frequency with anything open, such as receiver with top open or unshielded wires, you will hit commercial FM stations on 99.3 MHz. This is the 22.7 MHz energy times four doing its job. With everything buckled up, only the

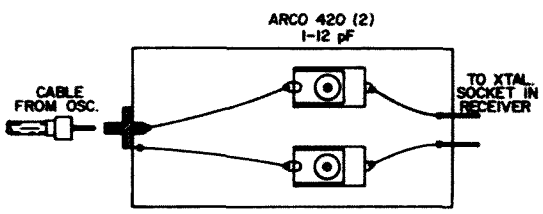


Fig. 6. Adaptor for connecting the 45 MHz output of the oscillator to a 2m receiver.

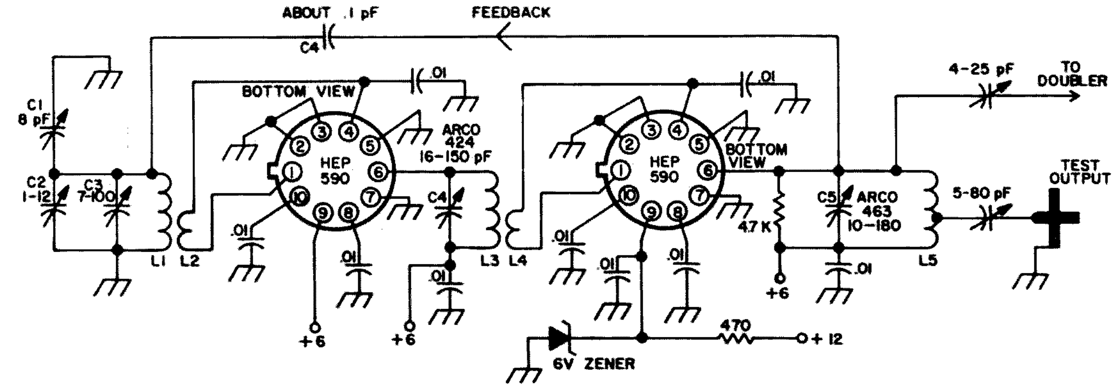


Fig. 7. Ultra-ultra stable oscillator schematic. This circuit offers superior performance over that of Fig. 2 due to the greater isolation between L1 and L5. L1 and L3: 15T No. 24, 1.2 cm long, 0.7 cm I.D.; L2 and L4: 1 T at cold end (check operation with leads reversed); L5: same as L1 with tap at center. Isolate or shield L1 from L5. C4 is a piece of wire positioned near L1.

two meter stations are received. Figure 6 also shows the way the two caps are mounted, and the pins which take the place of the crystal pins. I didn't have a "dead" crystal, so I used the pins from an old seven-pin plug from the old tube days. It pays to have a large junk box. Mine has it's own bedroom! The pins of the crystal used in the receivers I tried were all .040 OD. I imagine sets of pins spaced, in a header, are readily available but I have not checked on it.

Ultra-Ultra Stable Oscillator

This vfo is quite similar to the one described previously in this article, except for the use of two IC's instead of one. The purpose of course is to provide more gain and less feedback in order to have greater isolation of the frequency setting circuit L1-C1 in Fig. 7. This results in even greater stability than furnished by the single LC oscillator. Figure 7 will be seen to have only slight changes from Fig. 2. The coupling links are only one turn compared to the two turns in Fig. 2, and C4 is a gimmick about 1/10th of a pF. Also, L1 must be well isolated and/or shielded from L5, due to the large gain involved in the use of the cascaded 590 stages.

The doubler to be used can be the same as in Fig. 5, and the same procedure for tuning up each doubler can be used. The same tune-up method as used for the single IC oscillator can be used for the two IC job. A little more attention must be paid because of the three tuned circuits to assure enough bandwidth as C1 is tuned. This whole circuit, having much more gain, can be broadened out in bandwidth a great deal by putting low ohmage resistors across L3 and L5. You can see a 5K already on L5. You can go as low as 300Ω or even less. At that value the tuning of L3 and L5 will be seen to be quite broad. An interesting method for tuning up L1, L3 and L5 is simply to hook a signal generator into L1 by a one or two turn link around it and tune everything to 22.7 MHz. Use the test output jack shown in Fig. 7 coupled to a tuned diode. Of course, remove the feedback line from L5 to L1 when you do this! This circuit is a good one for a 30 MHz i-f for 1296 and microwaves.

Conclusion

Two integrated circuit oscillators have been described which are suitable for use as tunable local oscillators for FM receivers which are presently crystal-controlled. The output, usually in the 45 MHz range, is plugged into any crystal socket of the receiver and allows tuning over the range 146 to 148 MHz. A two position switch, optional, may be used to spread 146 to 147, and then 147 to 148 MHz, over 95% of the dial, for greater ease of tuning and repeatability. The first oscillator uses one IC for simplicity, while the second uses two for greater stability. Although all construction here has been of the breadboard variety, the layout of the oscillators as described could lend themselves well to PC board construction.

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A BASIC AMATEUR TV SYSTEM

ATV has become something of a stepchild of amateur radio in the last couple of years, as least as compared to its younger sibling, SSTV. There are several good reasons why this has happened. First of all, it is considerably more difficult to get any kind of a signal at all on the air in the fast scan mode than it is with slow scan. Second, and more important, there never has been much literature available that dealt with the subject. Even the most recent ARRL handbook makes only casual reference to the subject, and refers the reader to one article, published more than ten years ago, that describes a very primitive system using equipment that is not readily available. *73* has published some good articles on the subject, notably those by Tom O'Hara W6ORG, but none of these has dealt thoroughly with the problem of getting a reliable transmitter on the air at a decent power level. It is my intent to remedy at least a part of that problem in this article.

In dealing with the problem of putting an ATV signal on the air, there are five things that must be given serious consideration:

1. Camera
2. Transmitter
3. Modulator
4. Antenna
5. Sound transmission

The camera doesn't present much of a problem. There are a great many of them on the market. If you don't like the prices you can purchase them in kit form or as surplus.

The availability of surplus FM equipment has helped greatly with the transmitter problem, but one most choose wisely in this area. I'll return to this subject shortly.

W6ORG has designed a couple of excellent video modulators capable of applying excellent modulation to practically any transmitter. See the bibliography, or write to

Tom. He has wired and tested units for sale at reasonable prices ($15 to $20). I'll return to this subject too.

Antennas can be a very sticky problem in ATV, because of the great bandwidth needed for a standard TV signal. Most hams tend to shy away from the yagi because of its narrow band reputation. Collinears are unwieldy and very difficult to get working properly. Oh, they'll do some radiating, but getting the currents in all the sections equal so that the pattern is predictable and the gain is what is should be can be a knot of Gordian complexity. The log periodic has its points, but it is difficult from a mechanical standpoint. The helix, also difficult mechanically, presents loss problems when working stations with uniplaner (I think I made that word up) polarization. Corner reflectors are huge and the gain is quite low in view of the size of the antenna.

So what do we do for an antenna? Let's take another look at the yagi. Our initial rejection of it was due to bandwidth considerations. In reality much of the yagi's "narrow bandedness" is due to the matching arrangement, rather than some inherent quality of the antenna. If we're willing to settle for an swr of something a bit greater than unity, but not so high that it would cause serious losses, the yagi will do an admirable job in ATV.

I have had excellent results using yagis made up just a shade shorter than the handbook dimensions (they're usually cut for 432, while in the Kansas City area we're operating at about 440 MHz) and using a folded dipole for the driven element. The impedance of almost every multielement yagi is in the neighborhood of 20Ω. The standard four to one folded dipole steps this up to about 80Ω. Coupling this to a 50Ω line through a bazooka easily made from aluminum foil and plastic tape results in a 1.6:1 swr. The swr on a 75Ω line would be less than 1.1:1. Another scheme is to stack two such antennas one wavelength or multiple thereof apart and run open line of not more than 1.25 cm spacing between them. Now the impedance at the center of this line will be about 40Ω, for an swr of 1.25:1 on a 50Ω line. This approach has been verified experimentally, and it works very well.

There are three distinct systems of adding sound to video in use among amateurs today, not counting just sending the audio on another band. Closest to the real thing, and most expensive as well, is to use a separate FM transmitter and antenna, 4.5 MHz higher than the video carrier. Some ATV enthusiasts FM the video carrier with audio, detecting the sound on a surplus FM receiver and feeding its first i-f to the TV set. This is a clever arrangement, but the FM receivers have terrible noise figures and limited bandwidth, making a poor TV converter, and the TV set will usually detect the audio as sound bars in the picture, if only to a small extent. The third approach is to use a subcarrier generator. Don't let the term intimidate you. It's just a 4.5 MHz oscillator with a simple FM modulator. Its output is fed to the video modulator along with the camera output. If the video modulator has the proper bandwidth capabilities, any ham who can receive your video will also copy your audio on his TV set. The bibliography gives an excellent circuit if you like to build from scratch. ATV Research has a kit available for less than $20, and W6ORG sells a wired unit for a few dollars more.

Now let's get back to the subject of transmitters and video modulators. Your best bet is one of the surplus FM rigs. They will all put out about 15 or 20W, and some can be made to deliver quite a bit more. You are most likely to encounter GE, RCA or Motorola rigs. The GE and RCA units are by far the easiest to work with. They use dual pentodes (5894's or 6907's) in the final. I don't recommend them. If that sounds a bit strange, let me explain. First, these rigs use tuned lines for the input and output. This system is horribly inefficent as compared to either the coaxial or strip line methods. Second, the screen grid must be bypassed for video, using an electrolytic capacitor in addition to the rf bypassing. Tuning for proper modulation is very critical and difficult to maintain. Worst, these tubes heat like crazy. I had a 5894 that melted the solder on the tuned lines after about five minutes of continuous operation.

The Motorola T-44 transmitter strip, although somewhat more difficult to rework

mechanically, makes a much better TV rig. It uses a 2C39 in grounded grid in the final. These tubes, with proper cooling, can dissipate 100W! With 1000V on the plate, it's not hard to get 50W of video modulated rf out of one of these rigs. The real disadvantage of the T-44 is that grounded grid circuit. Since the easiest method of video modulation is grid modulation, this poses a problem. Actually, the 2C39 grid is not grounded for dc. It is connected to a copper plate that is separated from the chassis by a sheet of mica. My grid dipper shows the value of this capacitor to be about 1500 pF. This value is large enough to bypass much of the video. Grid modulating the T-44 as it stands, I found that the frequency response began to roll off at about 1 MHz, and that it had cut off completely by 2.5 MHz. The video definition was poor, and the audio subcarrier wasn't there at all.

Happily there is a way out. Take the output cavity apart (easy), make a couple of narrow shims from an epoxy PC board to space the copper grid plate further from the chassis, and put it all back together (hard). I found that tacking all of the copper and mica and stuff together with a few dabs of rubber cement made it possible for one human being with two hands to put it together again. This operation decreased the bypass capacitance to about 50 pF. Anything between 30 and 100 pF should do.

The above modification makes the final somewhat prone to self oscillation when the video lead is connected to the grid, so some rf filtering is necessary. Figure 1 shows the circuit.

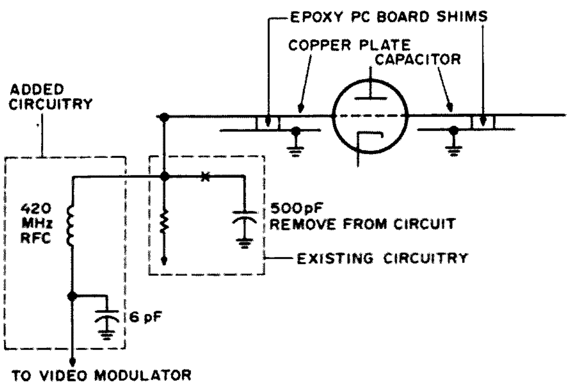

Fig. 1. Circuit modification of the T-44 transmitter strip to increase modulation bandwidth.

I am using a slightly modified version of one of W6ORG's video modulators. The circuit given in the bibliography is a good one, but it is imperative that the lead from modulator to final grid be very, very short. This is difficult to accomplish with the T-44, so I used the two transistor version shown in Fig. 2. The second transistor is an emitter follower that lowers the output impedance so that a longer line can be used without degrading the video. It's still a good idea to keep that lead as short as you can.

The capacitor that bypasses the emitter of the first transistor in the modulator plays a large role in determining the frequency response. W6ORG suggests a value of 470 pF. I am using about 1500 pF. It is best to play with this value once the system is operational. Too small a value will limit the definition, while too much capacitance will lead to video distortion.

It is possible to put a signal on the air and carefully tune the final and adjust the frequency response of the modulator while another ham monitors your signal, but it's not easy. The strong local rf will overload your receiver so you won't be able to tell what's really going on as you make each adjustment. Your best bet is to use a transmission line detector (Fig. 3) and watch the signal on a monitor or scope. While not an absolute necessity, a wideband scope will save you a lot of trouble. I'm using an RCA TM-6C Master Monitor, a combination video monitor and waveform analyzer. I bought it for $50 from a local TV station, where it had been replaced by a solid state unit. Denson has surplus units, although their price is higher.

To put the system in operation, first get the audio subcarrier oscillator on frequency. Either feed the signal into a standard TV set

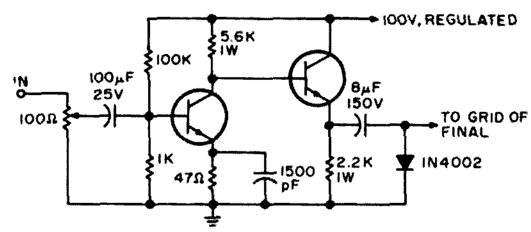

Fig. 2. Video modulator. Both transistors are RCA 2N3439 or 2N3440 with heat sinks.

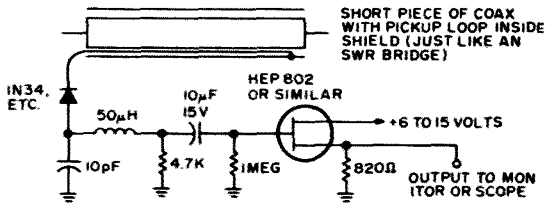

Fig. 3. Transmission line video detector.

just after the video detector, or use a general coverage receiver to set it at 4.5 MHz. Then set the level. With the TV set you should be able to hear the audio and adjust the level so the audio does not upset the picture. On a scope, the trace should thicken just a bit during the blanking pulses.

Now, connect the camera and audio unit to the modulator and fire up the transmitter. Tune for maximum output while staying within the tube ratings. Watch the scope or monitor as you adjust the modulator gain control. When you reach 100% modulation the top of the waveform on the scope will flatten out, and the whites in the picture will become washed out. Back off the gain control slightly. This is the time to play with the capacitor that sets the frequency response of the modulator. At the same time carefully tune the final around both sides of maximum output. The object is of course to get pleasing video and audio on the monitor, or on the scope, a pattern almost identical to that at the input to the modulator.

I have experimented with several ATV transmitting arrangements, and the system I've described, using the Motorola T-44 transmitter strip, out-performs the others by a considerable margin. I suggest that you read as much of the material in the bibliography as you can get your hands on before getting started. But do get started. ATV is the most exciting aspect of our hobby that I've encountered, and I think you'll agree.

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MAXIMUM PERFORMANCE FOR SMALL YAGIS

A grid of small dimensions in place of the usual parasitic element will increase both gain and F/B ratio.

Many hams face the problem of constructing an effective low band antenna within a limited space – the roof of a row house for example. Long Yagis are clearly ruled out, and cubical quads are not without their disadvantages. However, by a simple adaptation of the screen reflector principle long in use in amateur VHF work and currently popular for UHF TV reception, the performance of a larger array can be approached.

The Problem

The trouble with all (particularly small) parasitic arrays is that neither forward gain nor front to back ratio can be maximized independently of each other, or of useful bandwidth either. Use of a screen reflector element of moderate size as described below will permit the user to obtain close to the full theoretical value of gain, and better F/B ratio than can be realized with a single parasitic element in its place. But does a decibel more off the front and a few less off the back really matter?

I believe it does. Particularly in the amateur service – where power input is limited by law, and contacts are by chance and the vagaries of the ionosphere. The *radio transmission loss* (defined as the ratio of radiated power to received power) typically observed in long distance communication is tremendous. Suppose your good friend in QZ9 land is putting a modest two hundred watts into the aether, and one microvolt of it finds its way into your receiver.

By $P = E^2/R$, that's a meager fiftieth of a microwatt, or 160 dB less than came out of the transmitting antenna. When conditions are marginal, or the competition fierce, it is then that the extra care paid to, say, using RG-17/U (low loss) instead of RG-58/U, Type N (constant impedance) rather than UHF connectors and other "small details" pays off.

Every decibel counts. As applied to antennas this means the best gain and F/B ratio available per usable area. But a limited space ham need not settle for a limited performance antenna.

A Solution

An ideal (infinite) screen reflector antenna has the basic properties summarized in Fig. 1. Thanks to the inverse square law, among other physical phenomena, a practical reflector can be made relatively small in terms of wavelength and yet be nearly as effective. Moullin has shown both theoretically and by experimentation that there is

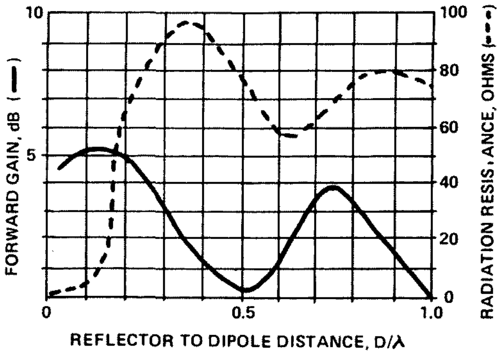

Fig. 1.

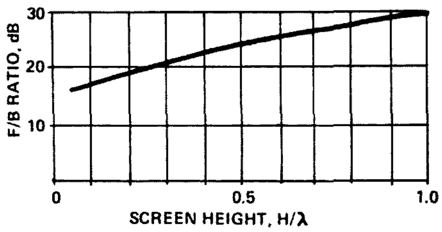

Fig. 2.

no substantial difference in performance between an infinite reflector and one slightly over 4/5 wavelength in height and 1/2 wavelength in width.

That's still fairly big for 15 meters, my favorite band. However, performance still drops off fairly slowly beyond this point. Figure 2 shows the variation of front to back ratio with reflector height for a fixed spacing of 1/5 wavelength.

Even so, one surely can't erect a large reflector made of aluminum foil! Theoretically, a parellel wire grid will appear the same as a solid sheet if the self inductance of the wires is equal and opposite to the mutual inductance between them. (The antenna is then properly called a grid reflector.) For small values of wire diameter relative to wavelength, the proper spacing of filaments is S = 15D/4, where S is the spacing and D the diameter of the wires, both expressed in the same units. Still, that's a might tight (and bulky) network.

Experimental Results

To determine the effect of increased failment spacing on performance, scaled down models for the 432 (3/4 meter) band were constructed. Because of the simplicity of the equipment employed only relative, not absolute, field strength measurements could be made. Nonetheless, I have determined that regardless of wire size, interfilament spacings of about λ/40 of less result in the same polar radiation pattern as the theoretically dictated one. (Vertical radiation patterns could not be relaiably determined, however.) That pattern is shown in Fig. 3. It should be noted though that the tuning stub on the driven element had to be adjusted for minimum standing waves each time the spacing was changed, indicating slight impedance variations with interfilament spacing.

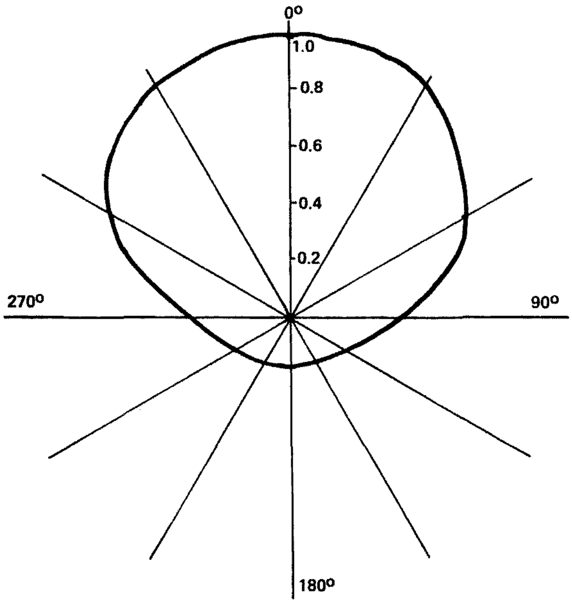

Fig. 3. Typical horizontal radiation pattern.

Construction Notes

My original antenna was a two element homemade 15 meter beam with the parasitic element tuned as a director and spaced 0.11λ from the driven element. A forward gain of 4 dB and a F/B ratio of 12 dB was realized; these figures can be taken as a typical compromise.

Two bamboo poles (chosen for lightness and cheapness, for this was just the prototype) somewhat over ten feet in length were mounted vertically on the ends of the parasitic element, now tuned as a reflector and spaced 0.15λ. See Fig. 4. Twelve lengths of #15 solid wire, each the same length as the relfector, were strung parallel thereto and spaced about ten inches (about λ/50)

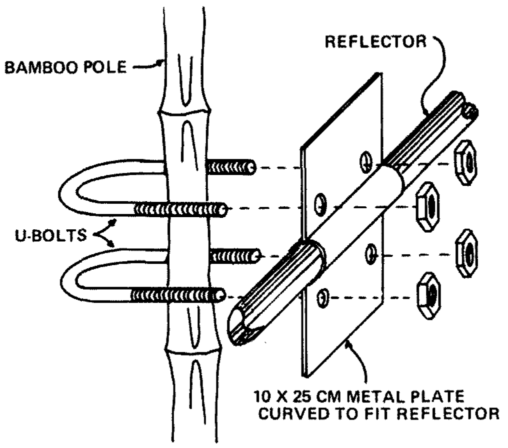

Fig. 4. Mounting of the vertical member on the reflector.

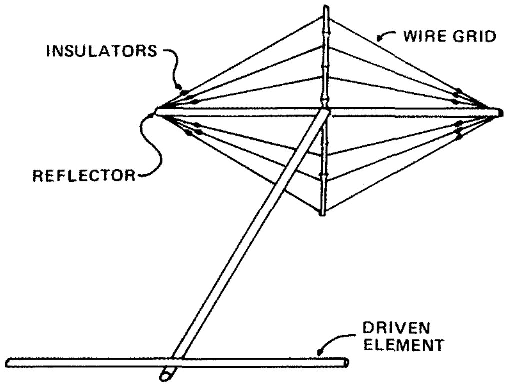

Fig. 5. Possible alternate configuration for lower frequency bands.

apart. The antenna was then raised to its original height of forty feet, with the point of support having been shifted considerably toward the grid.

Findings

On the air testing followed, comparing the performance of the new array with that of the dipole relative to which the original antenna was proved. Forward gain is in the order of 5 dB, and front to back ratio 20 dB. More subiective tests indicate that it compares favorably with a neighbor's commercial tribander for both short and long haul communications.

After successfully weathering a Philadelphia winter, the antenna was lowered for inspection and dismantled. New construction techniques are being developed for using this limited size grid reflector method on lower frequency bands. Shown in Fig. 5 is a sketch of the configuration currently under investigation for 20 meters.

For those many hams who, like myself, simply don't have the space available to lengthen their array, the type of antenna described in this article provides one further step toward full-size performance. Construction is simple, and the results are encouraging. Try it and see.

. . .WA3CXG

References

Henry Jasik, ed., Antenna Engineering Handbook, New York, 1961.

John Kraus, Antennas, New York, 1950.

E.B. Moullin, Radio Aerials, Oxford, 1949

AN ACCURATE FREQUENCY STANDARD

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303 Norton Circle
Smyrna GA 30080

The following material describes a versatile test instrument which may be constructed by the average amateur. It may be used as a calibration standard for receivers, VFO's, transmitters, audio oscillators, and oscilloscopes. While my particular circuit used a 1 MHz crystal, there is no reason why a 100 kHz, 5 MHz, or other unit could not be substituted. The IC's in the circuit are suitable for operation up to 10 MHz. Selected devices may be satisfactory even up to 15 MHz.

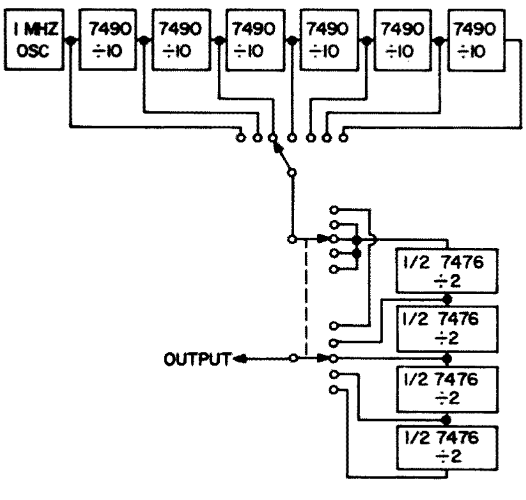

Fig. 1. Simplified block diagram of frequency standard.

Before presenting any detailed information it might be worthwhile to explain several points of interest about the circuit. First, the reader will note that the crystal oscillator circuit has been omitted. We assume that the average builder has a pet transistor oscillator circuit which he knows will work for him. Also, the circuit will depend upon the frequency of the crystal employed. Capacitor CI was placed across the output of the unit to reduce switching noise appearing in the output waveform. For this purpose it works satisfactorily. However, in applications where high harmonic content is desired CI should be removed. Notice that no output coupling capacitor or other means of isolation has been provided. This unit was to be used with

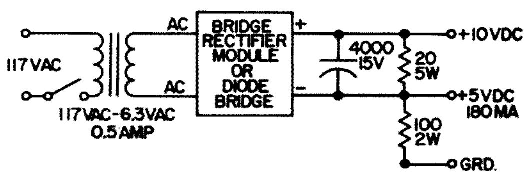

Fig. 2. 5V dc power supply using voltage divider network.

OBTAINABLE SWITCH-SELECTED FREQUENCIES

1,000,000 Hz	500,000 Hz	250,000 Hz	125,000 Hz	62,500 Hz
100,000 Hz	50,000 Hz	25,000 Hz	12,500 Hz	6,250 Hz
10,000 Hz	5,000 Hz	2,500 Hz	1,250 Hz	625 Hz
1,000 Hz	500 Hz	250 Hz	125 Hz	62.5 Hz
100 Hz	50 Hz	25 Hz	12.5 Hz	6.25 Hz
10 Hz	5 Hz	2.5 Hz	1.25 Hz	0.625 Hz
1 Hz	0.5 Hz	0.25 Hz	0.125 Hz	0.0625 Hz

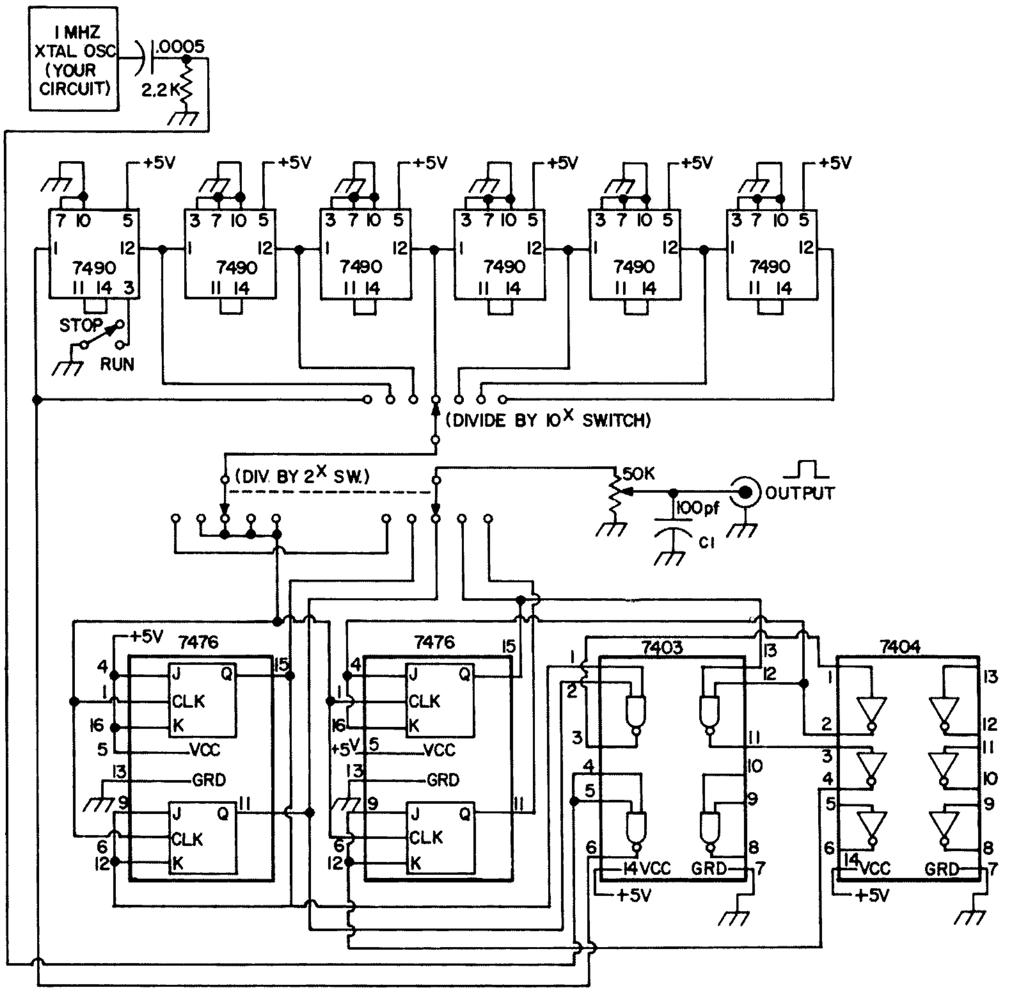

Fig. 3. Frequency standard wiring diagram.

other integrated circuit equipments and therefore nothing was required. Do not apply more than 5V dc to the output terminal at any time or destruction of the IC's will result. Some builders may require a more stable output voltage. The power supply shown is satisfactory for most applications of the frequency standard. A UA723 voltage regulator and pass transistor may be added, if desired, to yield a stable pulse amplitude.

If built as shown in the circuit diagram, the unit will produce a 2 volt square wave at the frequencies shown in Table 1. The accuracy of the higher frequencies will depend entirely upon how accurately you zero the crystal oscillator to WWV. A good idea is to listen to WWV on 25 MHz and work for a 25th harmonic zero beat, or as close as you can get. Back down at 1 MHz this will be a quite reliable signal. Division of the 1 MHz signal even further by the unit results in a highly accurate standard for the average amateur station.

All integrated circuit devices are 14 pin dual in-line packages except the 7476 dual J-K flip-flops which use a 16 pin package. A prototype printed circuit card for dual in-line package IC's was used for construction with wires run as shown on SK-3. Some builders may desire to fabricate their own boards and eliminate the wires.

Numerous modifications of the basic circuit are possible. In the interest of low cost and simplicity, most of the frills of commercially available pulse generators have been left out. What remains is an accurate source of frequency, TTL logic pulses, time interval markers, and audio.

. . .W4HSA

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A DIGITAL IDENTIFICATION UNIT

A TTL identifier that can be assembled, programmed and put into operation quickly. Adding a few components transforms the unit into a self-identifying electronic keyer.

The automatic generation of call signs is not new and a great many methods have been offered in the past. The older designs used often unreliable mechanical means, while most of the new electronic designs, although reliable, require several sheets of paper to figure out the programming. The unit to be described here uses state-of-the-art, inexpensive TTL logic and can be programmed in your head. To date nine units have been in use for almost a year in repeaters, RTTY stations, a CW station and a VHF beacon without any failures or wrong calls observed. After collecting all the parts and the PC board, the unit can be assembled, programmed and operating in less than 45 minutes.

How it Works

Chip U1 is a type 7400 quad two input nand gate. Sections a and b are set up in a free running multivibrator. Its operation is exactly like the transistor versions in the handbook. Pins 9-10 and 12-13 act as the bases and pins 8 and 11 act as the collectors of NPN transistors. The emitter is grounded internally. If the multivibrator should hesitate to run, momentarily connect a jumper between ground and the positive side of either capacitor. Because this circuit is ac coupled, it can turn on in a stable state. Once it is running, however, it won't stop until power is removed. Sections c and d are redundant and were used because they were in the chip and might provide some noise immunity. The clock pulse enters section c at pin 2. A control signal enters at pin 1. The control signal is a logic 1 (+5V) while the ID is running, thus allowing the clock pulse to exit at pin 3. When the ID is not running, the control signal is a logic 0 (0V) which closes the gate. This control signal is brought out on pin V along with its inverted function on pin U to control other low level functions that you might have need for. Section d is an inverter. The gated clock pulse enters on

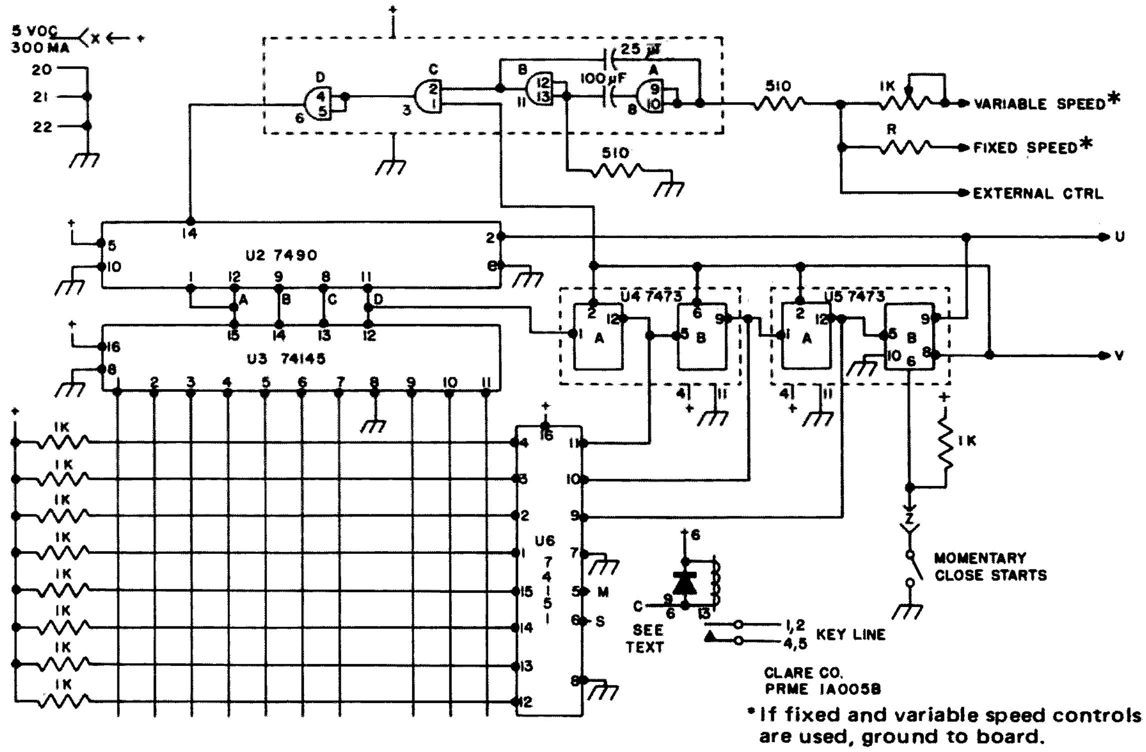


Fig. 1. K1OZS diode programmed CW identifier.

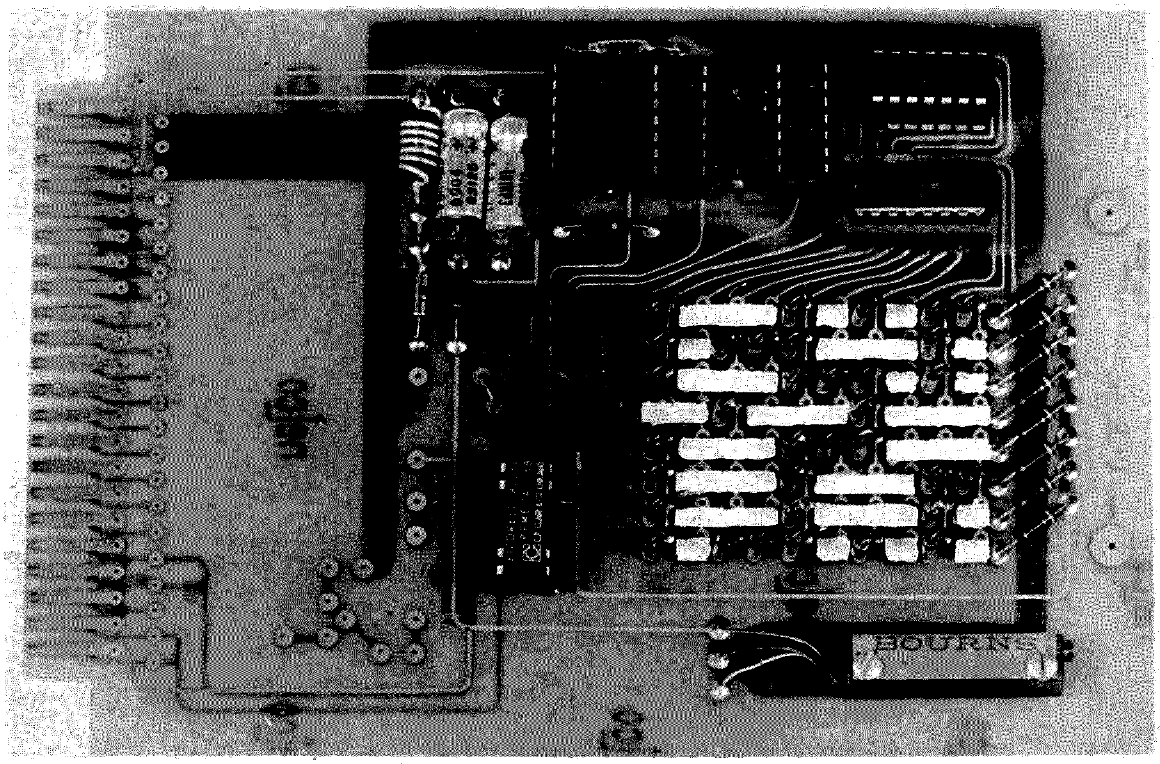
pins 4 and 5 and exits at pin 6 with the opposite phase.

Chip U2 is a type 7490 decade counter. Pin 2 is a reset to 0000 command. When it is at logic 1, as when the ID is stopped, the output count is forced to 0000 and cannot change even if clock pulses were applied. When the ID starts, the control signal goes to a logic 0 and the decade can count. Pin 6 is a reset to 1001. It is not used in this application and must be grounded. The 7490 is built in two sections internally and needs to be joined at pins 12 and 1 to get a decade count. When the ID is started, the clock pulse enters at pin 14 and the output counts in binary code, as shown in Fig. 2. Each time pin 11 goes from 1 to 0 it trips flip-flop U4. The four outputs from the decade counter go to the four inputs of U3, a 74145 one of ten decoder. The ten outputs of U3 are the collectors of ten NPN transistors, only one of which is on at any one time, that one being determined by the binary code at the inputs. If the input were 0000 and you were to measure all the outputs, you would find that pin 1 would conduct to ground and all the others would measure open. When the count changed to 1000 the on transistor would move from pin 1 to pin 2 and so on up to 1001 where the on transistor would be at pin 11 with all the others being off.

U4 and U5 act as an eight counter and control the start-stop functions of the ID. When the unit is at rest the outputs from U5b are: pin 9 = 1, pin 8 = 0. Pin 8 is the origin of the control function that goes to U1 and gates the clock. It also goes to U5a pin 2 and U4 pins 2 and 6, forcing the outputs of these flip-flops to equal 000. Pin 9 is the control function for the 7490 that forces it to 0000 output. Pin 6 of U5b is the reset pin and is connected to +5V through a 1K pull up resistor. If pin 6 is grounded for

pin	12	9	8	11
	0	0	0	0
	1	0	0	0
	0	1	0	0
	1	1	0	0
	0	0	1	0
	1	0	1	0
	0	1	1	0
	1	1	1	0
	0	0	0	1
	1	0	0	1
	0	0	0	0

Fig. 2. U2 7490 output.



Overall view of component side.

1 u sec. or more, U5b will reset, thus inverting its outputs. This removes the reset from U4a and b and U5a, allowing gate U1c to pass the clock pulses and allows U2 to count. Each time pin 11 of U2 goes from 1 to 0, U4a flips; each time U4a pin 12 goes from 1 to 0 U4b flips, which in turn does the same to U5a which eventually does the same to U5b as shown in Fig. 3. When U5b flips, the control signals change back and stop everything until U5 pin 6 is again grounded.

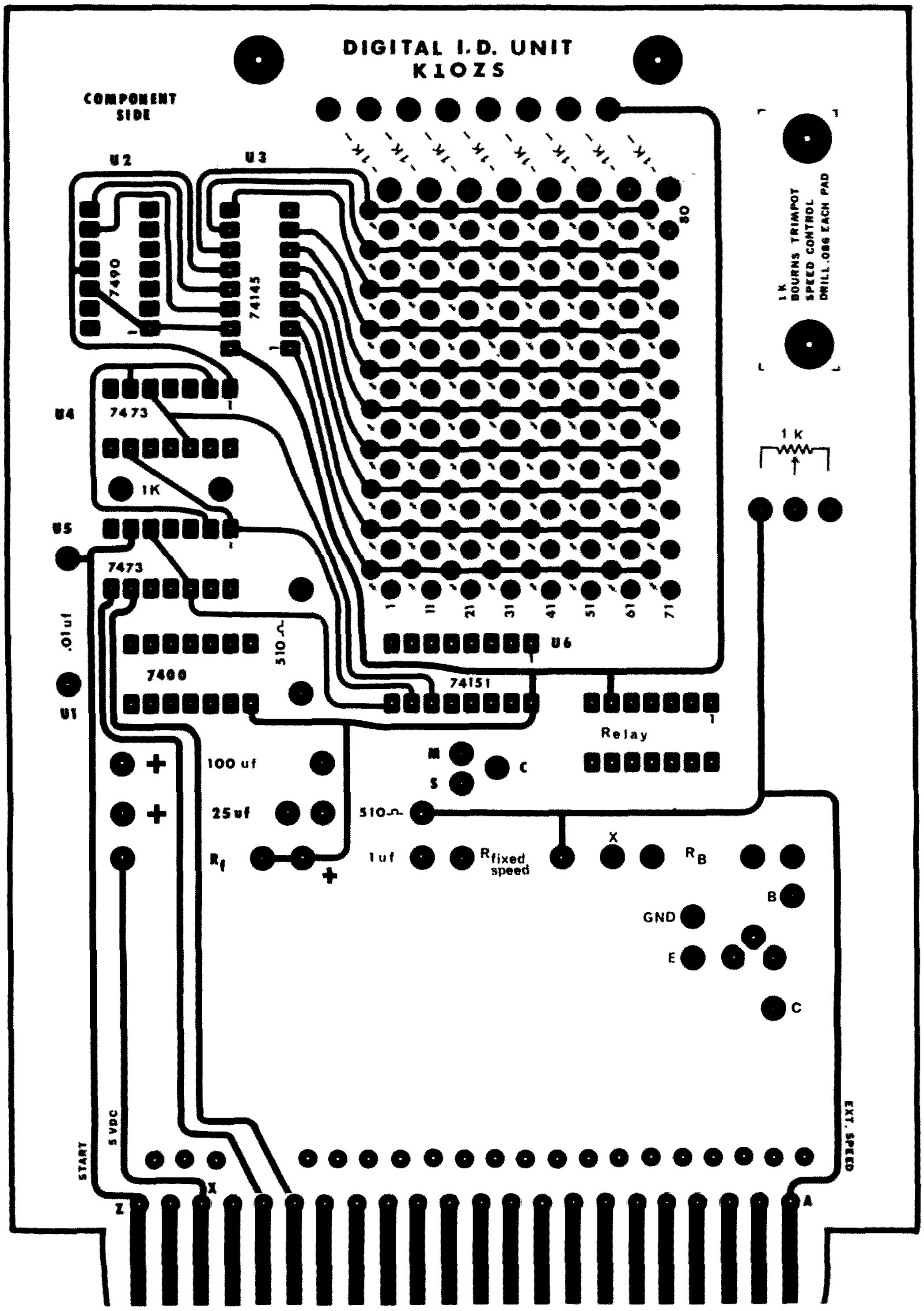
Chip U6 is a 74151, an eight channel multiplexer. It has eight input channels, any one of which can come out with the same

	U4		U5		
pin	12	9	12	9	8
	0	0	0	1	0 ID stopped
	0	0	0	0	1 start
	1	0	0	0	1
	0	1	0	0	1
	1	1	0	0	1
	0	0	1	0	1
	1	0	1	0	1
	0	1	1	0	1
	1	1	1	0	1
	0	0	0	1	0 ID stops

Fig. 3. U4 and 5 output.

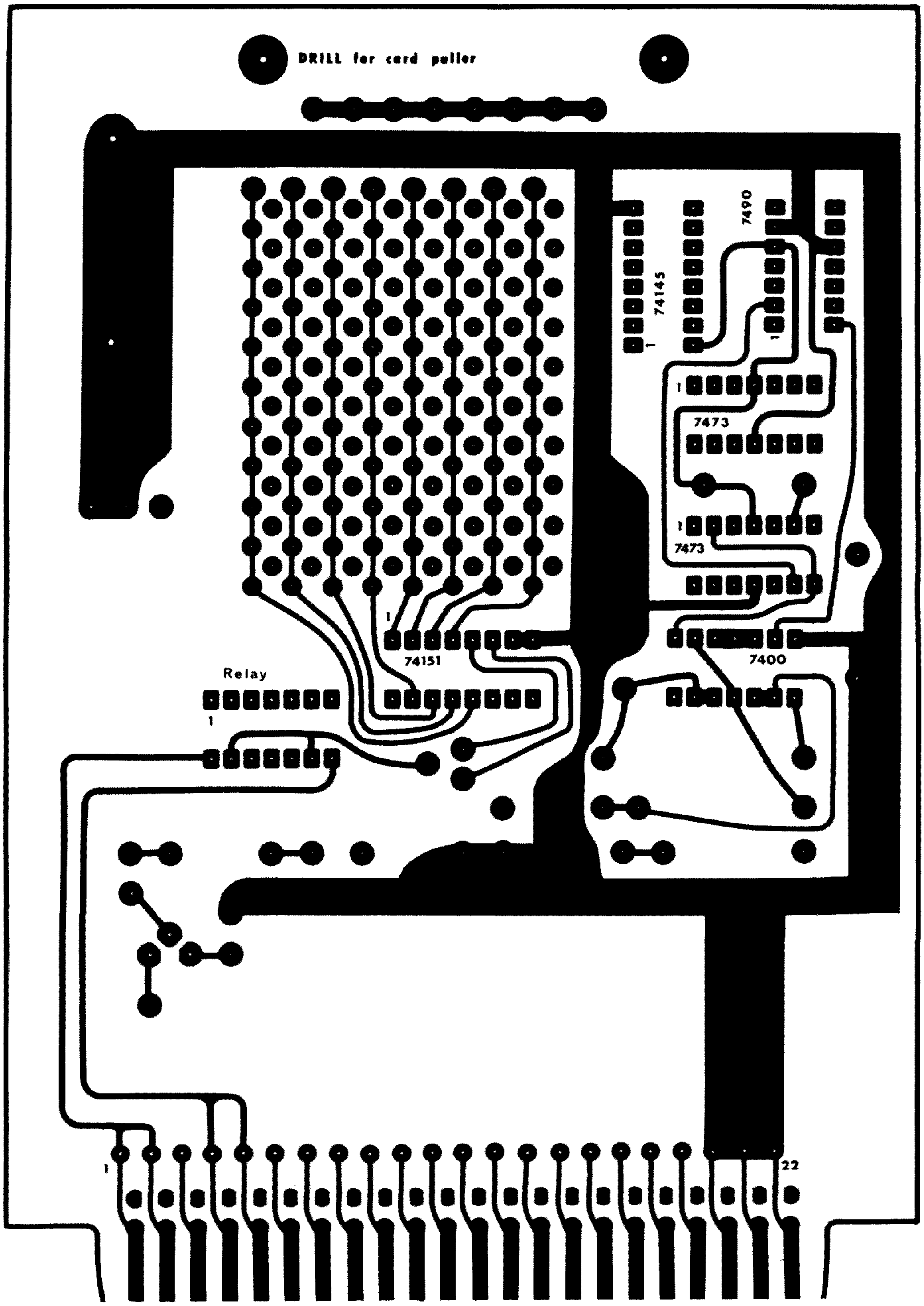
phase as it went in or can be read on the other output pin inverted. What channel is on the output depends on the BCD code on pins 11, 10 and 9. If they equal 000 only information applied to pin 4 will appear on pin 5 and its inverted form on pin 6. All other inputs will be ignored. If the code changes to 11 = 1 and 10 and 9 = 0 only information applied to pin 3 will appear on the output and so on up to 11, 10 and 9 = 1 at which time only information applied to pin 12 would appear on the output. All inputs are connected to +5V through 1K pull up resistors to assure that they return to a 1 state quickly.

The diode matrix is the memory and is read by U6 and driven by U3. Figure 4 shows a simplified version that will be easier to follow. It is read from left to right, top to bottom, just like a book. For an example, Let's program this small matrix to send dit dah dit dah. Before the start signal is given the ID is at rest and pin 1 of U3 is grounded because that transistor is turned on. Chip U6 is listening only to channel one on input pin 4 which is pulled up to a 1 by the 1K resistor. The relay is connected to +5V on one end and +5V through the chip and a 1K



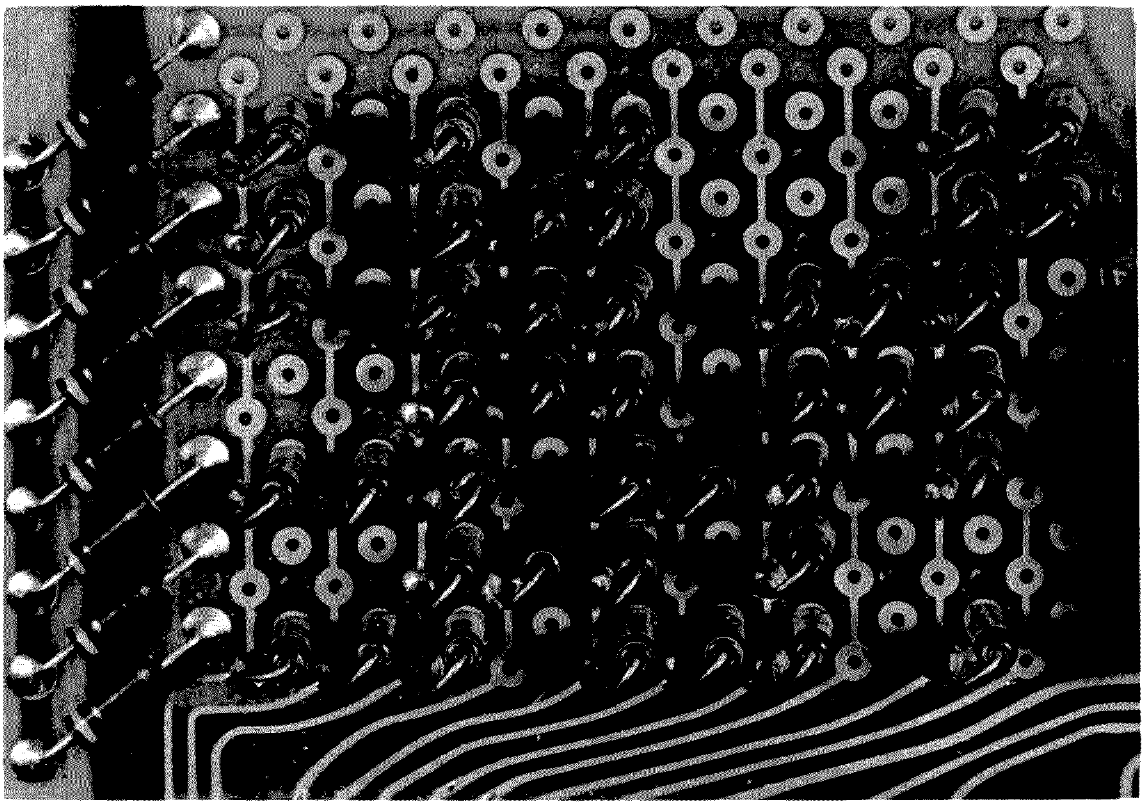
Circuit board, component side (full size).

resistor on the other end. No current flows and the relay is open or "key up." When the start signal is given the first clock pulse steps U3, T1 turns off and T2 turns on, grounding the line connected to its collector. Current now flows from +5V through the relay to D1 and ground, thus closing the relay. The second clock pulse turns T2 off and T3 on. Now no ground path is present for the relay and it opens, having completed the first dit of our character. The next clock pulse turns T3 off and T4 on, again providing the



Circuit board, reverse side (full size).

ground path and closing the relay. The next clock pulse turns T4 off and T1 on. When T4 goes off it steps U4 which advances U6, so it is now listening only to signals applied to pin 3 which in this case is grounded through D3 and T1, which causes the relay to remain closed. Because of the speed of the switching, the relay doesn't get a chance to open while U6 is changing channels. The next clock pulse turns T1 off and T2 on, so the relay still conducts through D4. The next clock pulse allows it to open. The



Close-up of matrix programmed for mark to send WA1OMS.

remainder of the matrix is read in the same manner until it gets to D8, at which time the relay is conducting. The final clock pulse turns T4 off and T1 on. When T4 goes off it trips U4 which returns U6 to channel 1, and sends out the control signals which stop the ID. As you can probably see, if a diode were placed at the intersection of U4 pin 1 and U6 pin 4, the relay would be on even though the ID were stopped. Therefore this position must be open or it will keep the key down when not in use.

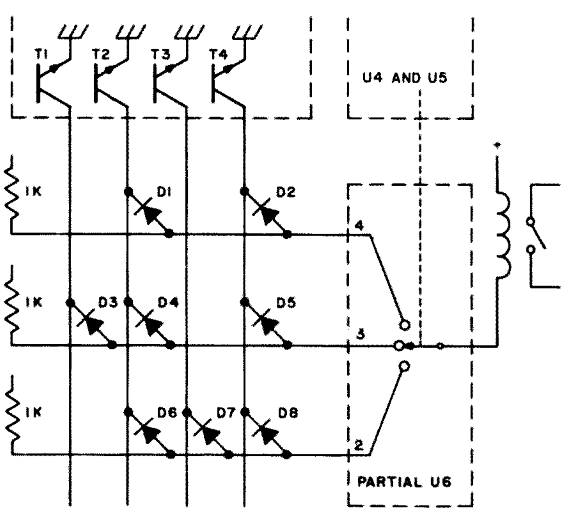
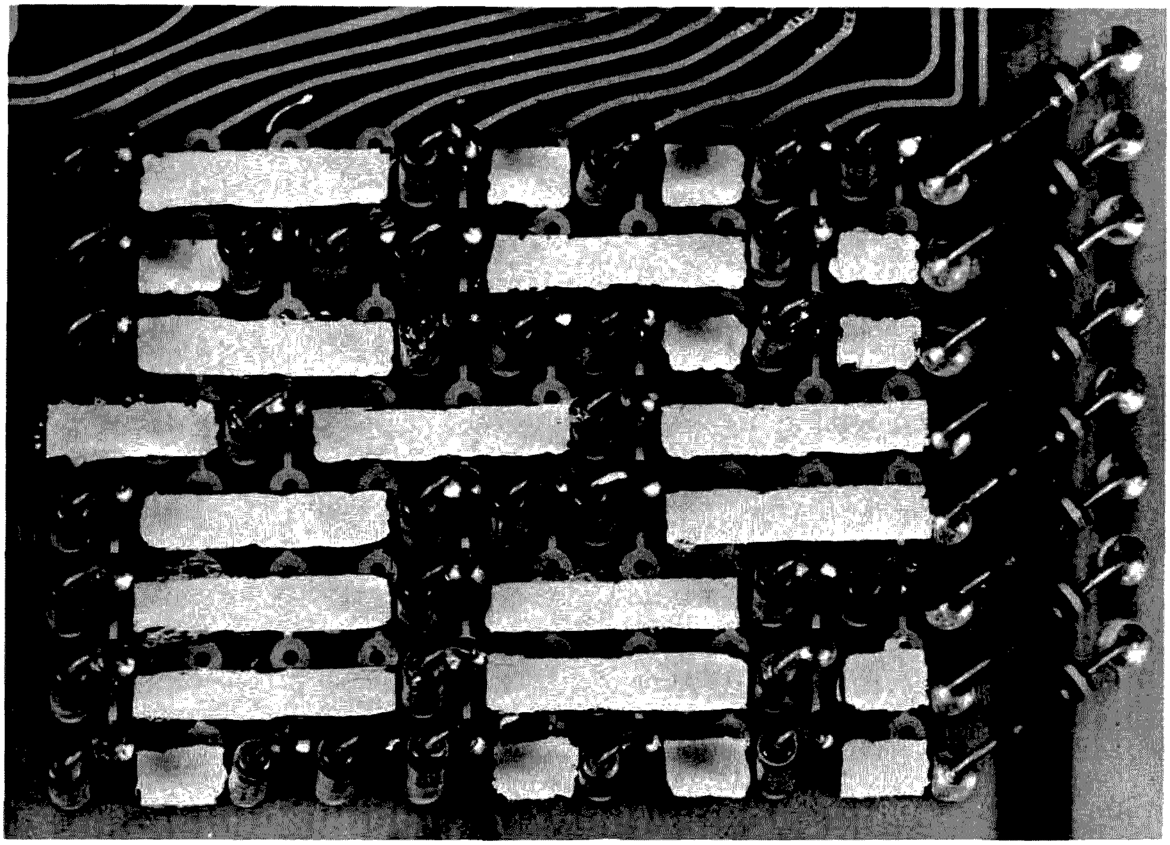


Fig. 4. Simplified version of the matrix. It is read from left to right, a horizontal row at a time, and is programmed to send dit dah dit dah. D1 is the first dit, D2, 3, 4 is the first dah, D5 is the second dit, etc. The blank areas between the bits are spaces.

The output relay used is the same size as the other chips, and it is sufficient to key the audio line from an oscillator or grid block key a low power transmitter. If higher power is to be keyed, a larger keying relay must be used with a transistor driver. Printed circuit for the driver and room for a larger relay are provided on the PC board.

Programming

There are two ways the diode matrix can be programmed, mark or space. Mark programming is like that described above in the small example matrix. Diodes are placed where you want the relay to close. To get a dot, use one diode, for a dash uses three diodes in a row. Spacing between dots or dashes in the same character is one space and



Close-up of matrix programmed for space to send deK1OZS.

between characters it is three spaces. When marks are programmed, connect the low side of the relay marked as C on the PC board to M which is pin 5 of U6. Because U6 also has an inverted output it gives us the option of programming for space. To do this simply put the diodes everywhere you would not put them when programming for mark, and leave them out where you would have put them when using mark. Connect the relay terminal marked C to S, which is pin 6 of U6. Note also that when programming for space a diode must be included at the intersection of U3 pin 1 and U6 pin 4. The capability to choose which way to program is handy if you are short on diodes, as one way usually uses fewer diodes. To decide which way to go, write your call out in code as in the example . – . – and count up the number of diodes needed for mark. One diode for a dit and three for a dash. In this case we get eight for this one character. If the number is forty or less, program for mark; if it is over forty subtract the number from eighty and that is the number of diodes to use to program for space.

Construction

The value of all components are marked on the PC board so placement should be no problem. The chips should be mounted in sockets, but may be soldered in if you are sure of them. The best type of socket to use in this case would be Molex pins because unless your PC board has plated-through holes, the pins must be soldered on both sides if a track comes to that pin on the component side. The board I used did not

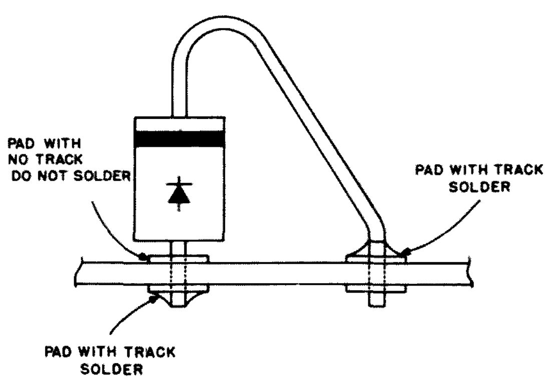


Fig. 5. Method of mounting the matrix diodes.

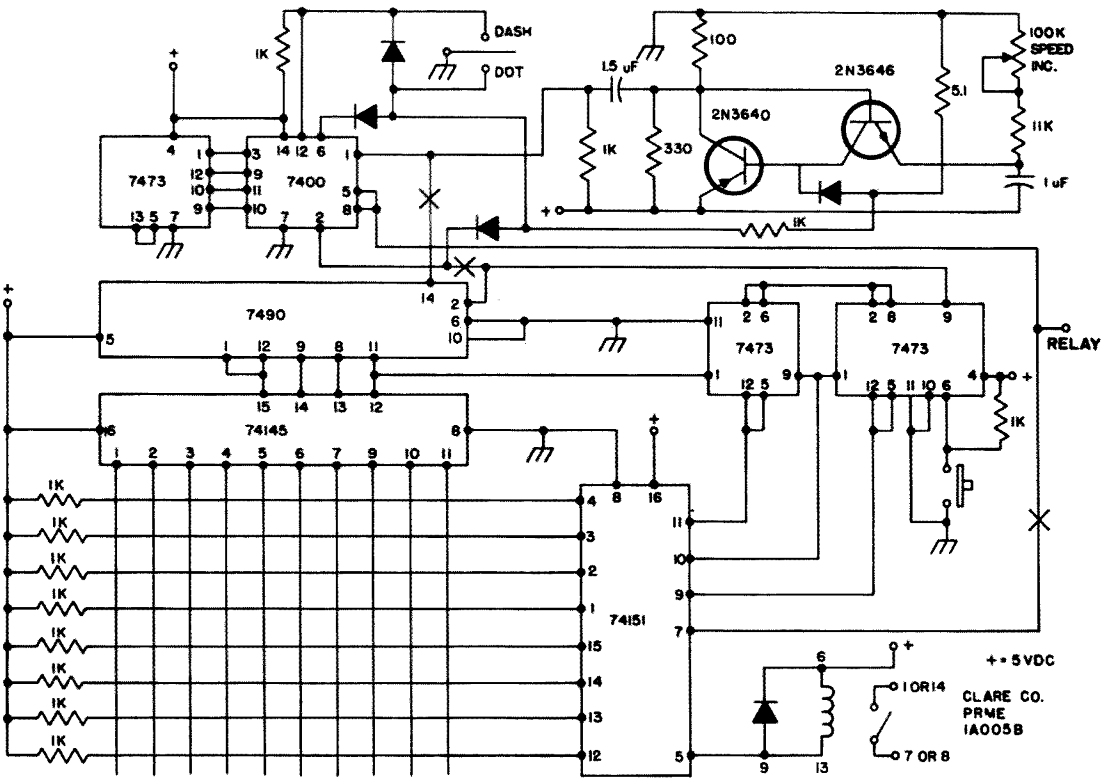


Fig. 6. One chip and two transistors add an electronic keyer to the ID unit at the three points marked with an "X."

have plated-through holes, and I didn't have any Molex pins. I found that by elevating the socket with a piece of board and bending the iron tip, the pins could be soldered without much difficulty. Solder the component side first so the joints are reheated when soldering the back, thus reducing the possibility of a cold solder joint. The diodes are mounted as shown in Fig. 5. All diodes used were 1N277 but many diodes were tried and they all worked. The card plugs into a Vector #980 socket.

Three methods of speed control are provided: (1) a small Bourns trimpot may be mounted on the card or (2) an external pot can be run between pin Z and ground. (3) Once the desired speed is found, the pot can be measured and a fixed resistor chosen and mounted on the PC board at the location marked "R fixed speed." No more than one method can be used at any one time.

No 5V supply is shown, but it should be capable of 300 mA. A simple regulator works well. For additional protection a ½A fast blow fuse followed by a 6V zener to ground can be used. If the power supply should go above 6V the zener will draw enough current to blow the fuse.

Other Applications

To make the ID useful to the CW station, one chip, two transistors and a few components need to be added so it includes an electronic keyer. No PC board has been laid out at this time, but the schematic is included in Fig. 6 for those who would like an electronic key that at the touch of a button would send out their call at the same speed the electronic key is runing! Note that when using this schematic the matrix must be programmed for mark. The circuit may be broken at the points marked X, and you have a TTL version of the W9TO keyer.

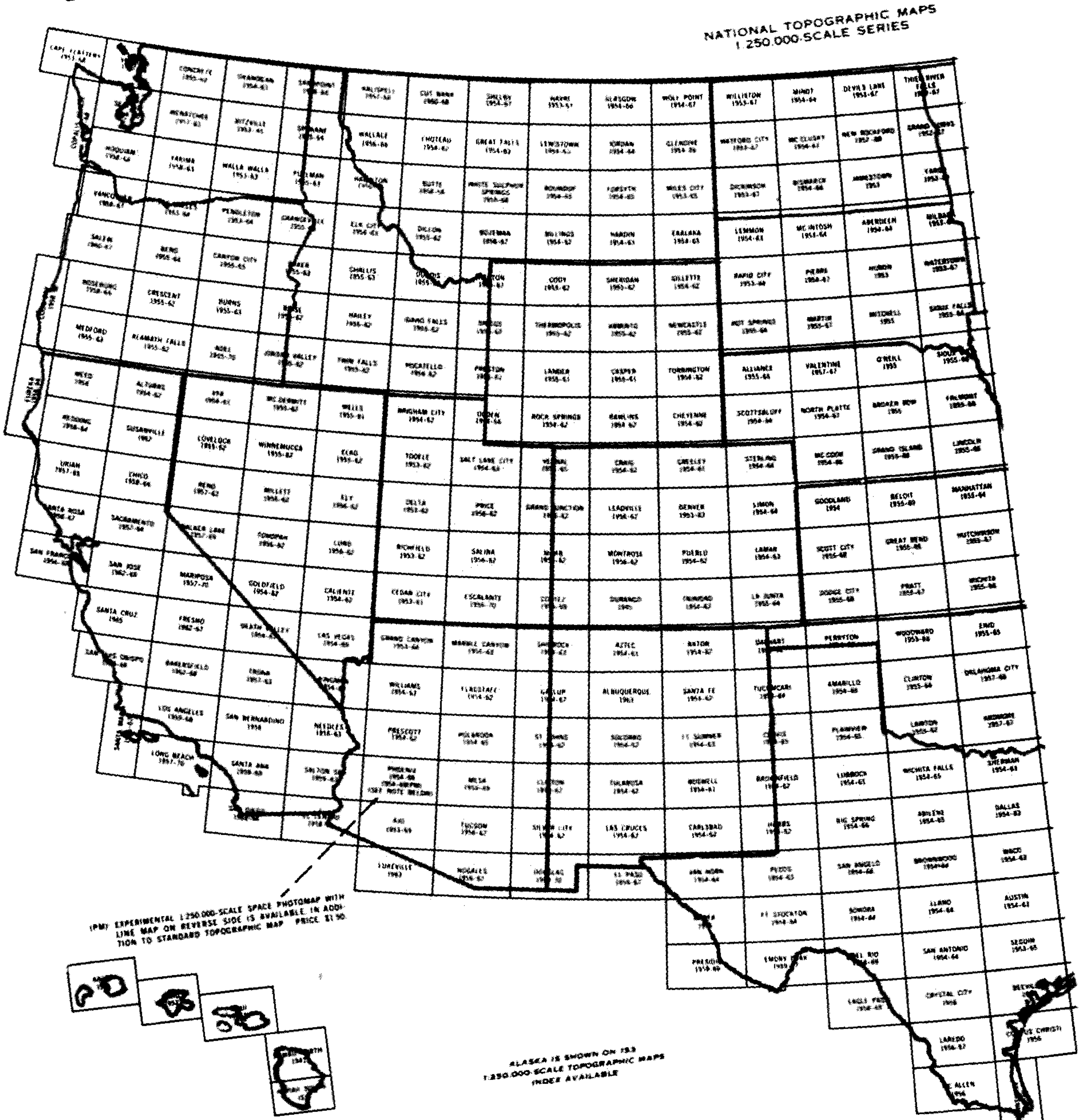
Circuit Boards

Etched and drilled double sided circuit boards for the digital identification unit described in this article can be had for $8.95 postpaid from MFJ Enterprises, P.O. Box 494, Mississippi State MS 69762.

...KIOZS

REPEATER MAPS

These maps are part of the National Topographic Map Series published by the Geological Survey, which includes several series of quadrangle and other topographic maps of the United States, Puerto Rico, Virgin Islands, American Samoa, and Guam.



HOW TO ORDER MAPS

Published maps are indicated by name and date of survey. Where two dates are shown, the first indicates the last year of survey for the basic information and the second date, the year in which limited revision was made. This revision generally consists only of the addition of such features as major highways, airports, dams, and reservoirs.

Most topographic maps are available either with or without green woodland overprint. Specify which edition is desired and whether substitution of the other edition is acceptable.

The list price of each map in the 1:250,000-scale series is $1. Prepayment is required and may be made by money order or check, payable to the Geological Survey, or in cash – the exact amount – at the sender's risk. Postage stamps are not acceptable.

At a scale of 1:250,000, 1 inch on the map represents about 4 miles on the ground. Because of the limitations of this scale, detail is somewhat generalized and some small features are omitted. These maps are useful in planning projects extending over large areas, such as selection of radio station sites, and absolutely necessary in preparing repeater license applications.

Maps can also be bought directly at U.S.G.S. Public Inquiries Offices at the following addresses:

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Send to U.S. Geological Survey, Washington DC 20242.

Dave Ingram K4TWJ
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Birmingham AL 35210

MOBILE--AND DXING TOO

Say, have you been thinking about going mobile but have been putting it off thinking possibly the cost wouldn't really warrant it? Possibly you feel you're not really in the car enough to enjoy mobile operation. Maybe you've heard it's too much of a disadvantage to make it worthwhile. Mobile hamming does have its advantages, though.

You can, for example, take advantage of a good location, like atop a choice hill in an extremely quiet place. And usually a DX station will try a little harder to pull a mobile through to prove his rig is top-notch.

If you're running mobile now, you may not really be pleased with the way you get out. You say you're not working much DX mobile? Afraid to get in the pileups or go after the semi rare "goodies?" Well, read on, amigo.

Let's take it from scratch and assume you have the bare essentials (an auto and the desire).

If you want an inexpensive rig, you can pick up one of the used single-banders for under $100; the popular Heath power supply will power practically all the medium power transceivers. If you want to roll your own power supply, Triad's TY series of toroids are very nice and come with a complete schematic packed along with them for typical power supplies. If you are really gung-ho, uncased toroids are quite plentiful these days. There have a been a number of articles on using these in dc power supplies, so it won't be covered here.

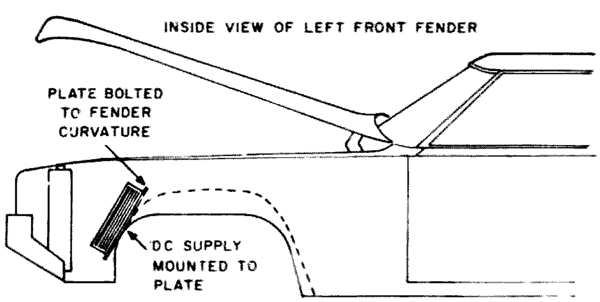

Fig. 1. Power supply mounted against metal car body for maximum heatsinking.

When you mount that supply, remember to put it under the hood against a flat surface to dissipate the heat into the car body. If your fenders don't have a flat surface, use a Seezac plate mounted onto the curvature of the fender, and mount the supply onto this.

Bonding is important, not just to eliminate ignition noise, but to give a more uniform ground and thus a lower swr. Using heavy braid, such as the shielding from a length of RG-8/U, ground the hood on both sides near the windshield at hinges to body, motor front and back on both sides to body, tailpipe in at least three places to body, and trunk, both sides at hinges to body. Be sure to put braid under the bolts in all cases for a solid contact – and for pete's sake, ground the mobile rig to the car body.

Antennas

The antennas manufactured today are much better than the old "whips," and it's well worth the cost to invest in one of the new chrome jobs; again, if you want to try a dandy antenna, why not a phased pair? Use two identical antennas and mount as far apart on rear deck or bumper as practical. Feed each with equal lengths of transmission line (50Ω, like RG/8U or Belden's low loss 8214) spaced on each side of the car (length is approximately 640 cm). Terminate each in a PL-259 at rear of rig and use a tee connector (Amphenol 831T) for connection to the rig (see Fig. 2).

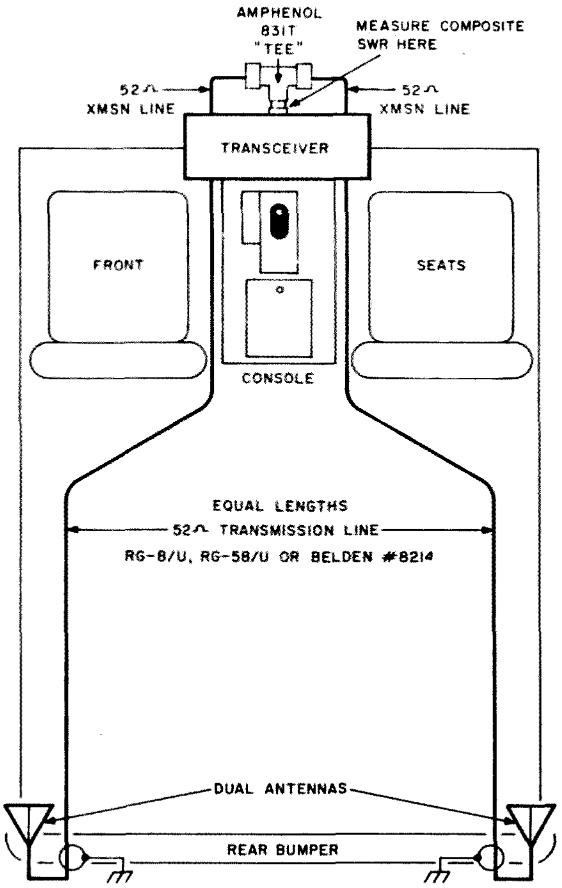

Fig. 2. K4TWJ's phased mobile verticals.

The swr is worked out by connecting each antenna, one at a time, to the rig, trying to get each swr as low as possible, then connect the two into the tee and measure the composite swr between tee and rig. This little system has worked quite well for me, and I have even tried adding a quarter wave to one leg of the feedline to change directivity. When doing this be sure to remember the one quarter wave also has to take in account velocity factor of the coax, thus one quarter wave X velocity factor of coax = actual length. The only problem with phasing is that it makes the antenna system basically a single band job whereas feeding both in phase will work all bands. Naturally the system is at a disadvantage due to the close spacing, but it still gives good gain. Of course, the antennas will work better on say 10 meters than on 80 meters; but even on 80 meters it will surprise you.

If you're running mobile at all be sure to throw in a compressor. This will prove to be your best dollar-for-dollar investment for the mobile rig. A compressor very often makes the difference on those DX QSOs. I have yet to find a time my compressor didn't give me at least a 5 dB gain and often up to 10 dB gain. I've found most units very nice and fairly inexpensive, but for the home-brewers there is usually a good compressor circuit in practically any ham magazine you pick up. I keep mine between the bucket seats so it is ready for those DX QSOs.

If you would like to know what it's like "being DX" or to be on the other end of a pileup, try the county hunters nets while mobiling through those off-beat counties; but be prepared – sometimes the pileups get heavy and it's up to you to handle things efficiently without letting the calling get out of hand. Good locations are on borders of two or three counties at one time, thus you pass out three counties instead of just one. These guys are usually sharp on QSLs too, sending you blanks to fill in and sign, so cost is nil for you. The CHs are on 20 meters and 40 meters every day and always listening for the rare mobiles.

Mobile Speakers

A speaker on the seat is handy when digging for that weak DX, but a bit awkward – first thing you know you either have the speaker to your ear or are leaning over like a typical drunk. I especially have a rough time because noise is extremely heavy in a convertible with the top down, thus the "DX Speaker" was born – the speaker (see

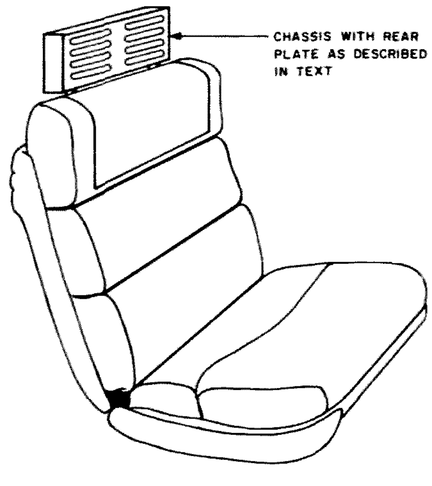

Fig. 3. Mobile speaker acts almost like headphones.

Fig. 3) is made from an auto accessory "slip onto the seat" type of headrest, and a chassis. These slip-on headrests are readily available at most auto accessory shops and many large department stores. Since we don't use the top part of the headrest, only the bottom (the piece that slips over the top of the seat and has adjustable top extenders) a damaged headrest is the ideal bargain. Most stores will sell them for what they can get as it wouldn't be worth it to ship it back to the factory. I found a tan headrest with the top slit, and bought it from the manager for $1. Another dollar for a spray can of leather dye and it's black to match the car's interior. Now, measure for the "speaker cabinet" (chassis) leaving ample overlap for the mounting bracket. Drill the chassis in a pattern for the grille, mount the speaker, close the bottom (or rear) with a bottom plate and cover with vinyl to match interior. Now you have a fine looking speaker which, being right at your ear, is just like earphones. DX comes through like a pair of professional cans and with volume to spare when outside noises are high. (Stereo owners could put two speakers, one left and one right, rather than one in the middle, and wire it to their stereo).

Other Ideas for Better Mobile DX

Carry an ac supply in the trunk for those spontaneous portable excursions or when you are near ac lines. You would be surprised how often it will come in handy and give you a chance at DXing you otherwise wouldn't have. You don't need a fancy supply, just one from junk parts – mine cost $5 and will run any transceiver under 300W.

Phased verticals are quite an improvement over a whip.

Next time you need a battery try the Delco Energizer group (used in police cars and ambulances, these batteries have a high ampere hour rating and are quite beefy).

Extra sulfuric acid is available from battery rebuilders and make nice, strong, healthy batteries out of the older ones.

Also, 24-hour clocks are fairly common for DX-minded autos. These 24-hour clocks are on deluxe models of cars and are usually interchangeable with the "economy" counterparts – for instance – the Pontiac GTO 24-hour clock and Pontiac Le Mans or Tempest are interchangeable. A salvage yard is an inexpensive source of these.

Most cars which have the antenna mounted on the rear have a slight gain over the right front fender, so try to face the car toward the direction you are calling. It's often possible to get a reflection off water towers or buildings for a little extra gain – by putting the car about 20–30 ft. from the water tower, with tower behind antenna, and car pointed toward station you are calling.

And, if you try CW mobile and don't have a CW monitor, try picking up your signal on the AM radio – usually I can get my keying with a fair tone toward the high end of the band (1400–1600 kHz).

Procedures

A little finesse is in order when operating mobile – if you indulge in pileups. Be sure the word "mobile" makes it in during a lull in the pack calling. Often I find things like "Alabama mobile" followed by my call (which I know gets drowned out) catches the DX attention enough so they will give a special listen for me (this is when that speech compressor comes in handy).

So there you have it, and the next time business calls or your vacation falls unavoidably during the DX contest, at least all won't be lost, and you may soon find DXing mobile is not just a novelty. I still need things like YBØ VU and 9N1 mobile so the next time you hear me in a pileup give me a chance.

. . .K4TWJ

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Churchville PA 18966

450 MHz POWER DIVIDER

The 420 MHz band is a mecca for amateurs who wish to construct elaborate antenna systems without undue strain on both their pocketbooks and towers. A common method of achieving this goal involves the stacking of many smaller arrays to form one high gain antenna system. Such a system requires the effective and efficient distribution of arriving energy in order to fully realize maximum potential performance. This article describes a "power divider" which meets the above requirements and is easily constructed in the home workshop.

The design shown is for use with four identical 450 MHz antennas, each with a 50Ω unbalanced feed. The basic idea could be extended to other bands and impedance combinations.

Basically, the device is two parallel connected quarter wavelength coaxial transformers in an integral section of 50Ω coaxial line. Each quarter wave transformer steps the parallel combination of the 50Ω antennas (25Ω) up to 100Ω. The transformers in parallel then result in an impedance of 50Ω to match the transmission line. Figure 1 illustrates the basic arrangement.

Construction of the device is relatively simple and requires only a few basic hand tools, electric drill and a soldering torch. All necessary dimensions are given in Fig. 2. All joints are sweat soldered as you would do for any home plumbing job. The end caps and access hole cover are fabricated from copper flashing material.

One further caution comes to mind. If the antenna ends of the homemade hardline

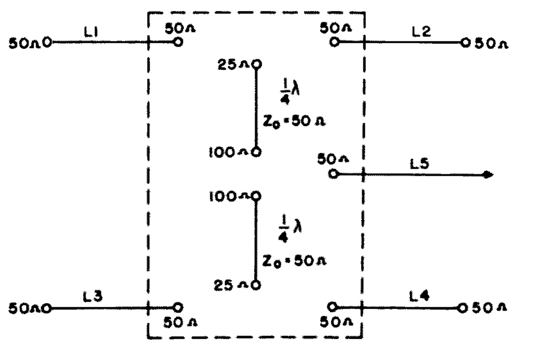


Fig. 1. Basic arrangement of the power divider. L1 = L2 = L3 = L4.

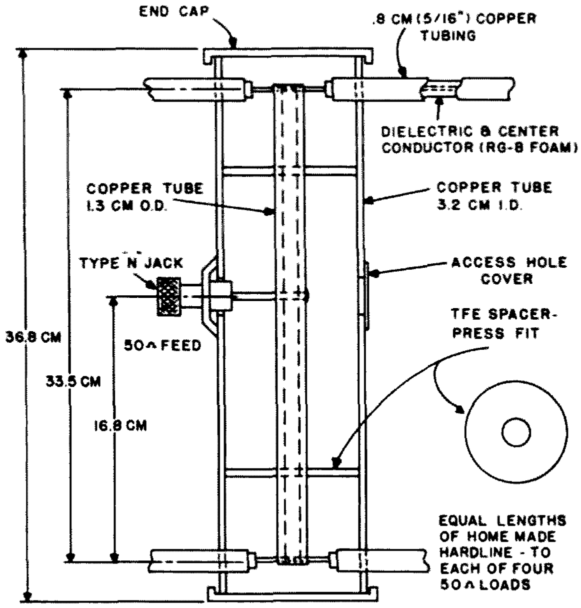
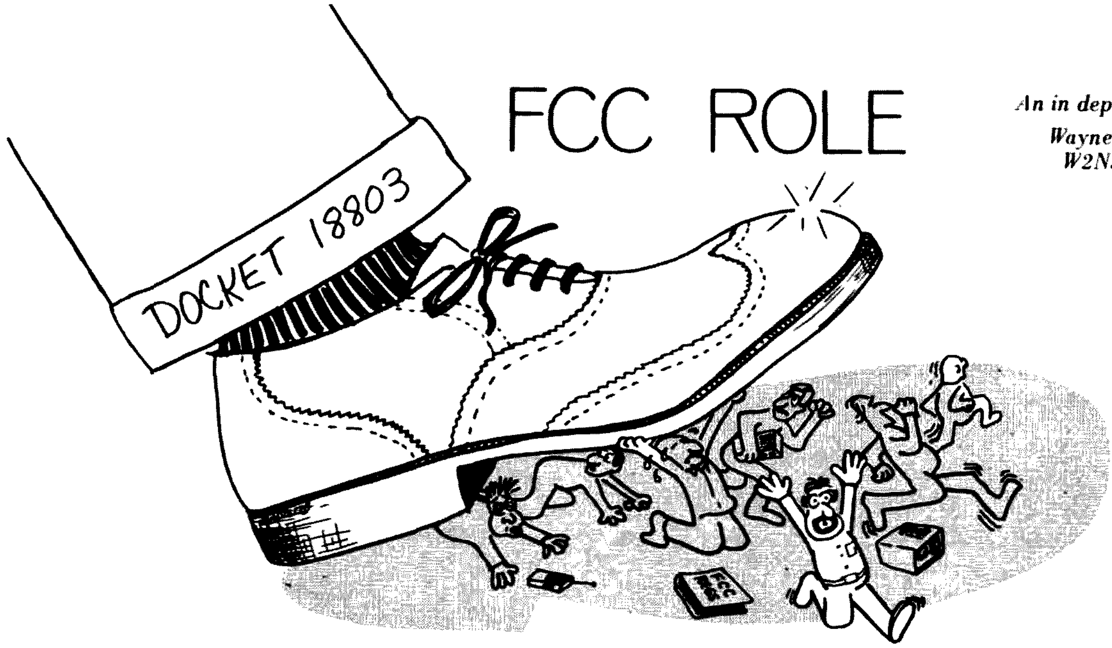


Fig. 2. Construction details of the 450 MHz power divider.

are to be exposed to the weather they must be completely sealed. This can best be done with silicone rubber, remembering to cover all the dielectric material projecting from the jacket. If a 4 to 1 balun is to be used, it can be made from the same material as the hardline and likewise carefully sealed. With a little imagination, ordinary type "N" plugs can be mated to the copper hardline if required of your installation. Also, K2KVT has developed a simple gamma type feed system which uses homemade hardline. The extension of the dielectric and center conductor, into a concentric metal sleeve, form the gamma capacitor. Food for thought.

This feed system is presently in use at my QTH with four commercial 8/8 slot-fed antennas. The installation is very neat in both appearance and performance and should remain so for many years to come. Keep in mind that the only really unique feature of this device is the construction technique. There are no expensive "N" connectors (except for the feedline) and the system is completely weatherproof. The homemade copper hardline is very low loss and will not contaminate nor degrade in performance over the years. Remember, a watt saved is a watt radiated!

. . .WA3AXV



FCC ROLE

An in depth look by
Wayne Green
W2NSD/1

Perhaps I am just too conservative for this modern progressive world, but my concept of the amateur regulations is that they should keep step with the needs of the hobby – not try to guess the future – and not fall too far behind. This is why I have on several occasions editorially suggested that some sort of yearly or semi-yearly convention for considering rule changes might be advantageous.

The recent rules seem to be written in an attempt to set up protection against some far distant future problems that amateur radio might have rather than meeting the exingencies of the present. Since few people have had any success in divining the future, I believe we have a right to object to Mr. Walker's attempts along this line.

The recent rules certainly appear to have little bearing upon any present problems as far as repeaters are concerned

Outside ot a need to have the regulations catch up with the fact of repeaters, little legislation was needed to preserve order. Repeater councils had taken on the job of smoothing out our growth problems and the result was probably the least painful rapid growth in the history of amateur radio. I suspect that the main people crying for rules were those who were able to cooperate the least with our repeater councils. They probably wanted government rules to force others to accept their way of doing things rather than their going the way of the majority.

So here we are with repeater growth virtually stopped – crossband operation illegal – most experimentation either illegal or so bound in by paperwork that it is not worth pursuing.

Does anyone agree with me about the purpose of the FCC rules and changing them only when absolutely necessary?

The Paper Barrier

The new rules would seem to generate a barrier of paperwork fo the repeater group or even control operator who is anxious to abide by the book. For instance, as I read the rules, every time I want to change the location of my repeater I must file first with the FCC and await their authorization. It is not yet known whether this will require the usual $4 modification fee, but I expect it will. As the rules are written I would expect that even moving my repeater to another building a few feet away from its present location would require this application and fee and wait for Washington to act.

The 73 Radio Club repeater may be different from many others, but one fact of life for us is changing antennas. We try one for a week or so and then another . . . and another . . . and another. We've had over two dozen different antennas on the repeater in the last two years that we've kept track of. From now on we will have to file for a repeater modification for every antenna change – with a fee? – and await permission to make the change! Just moving the antenna a few feet higher is another modification – complete with filing, fee and wait.

Now let's say that the final amplifier goes out and we have to operate on reduced power. Is that legal? I think not! I think we have to file for a modified license, with fee, and await authorization. In the meanwhile we would have to stay off the air.

Each time a control operator moves, a new one is added, or an old one deleted, I believe this requires a modification of the repeater license, with fee, and wait for authorization from the Commission.

Now perhaps you think these license applications and changes are simple to apply for. The fact is that some 500 repeater applications have been processed by the Commission so far and the last I heard over 90% of them had been rejected. Some day it may be relatively simple to apply for and get a repeater license – a control station license – or an auxiliary link license – but that day is not yet within sight.

Delays

And what about the delays. Our commercial brethren, who have been suffering under this type of paper blight for years, tell us that weeks and even months can pass before authorization is received. To get right down to the facts of today – we sent in a telegram requesting special temporary authority to operate a new repeater experimentally for one day. We followed this a few days later with a phone call and were told that we could expect about eight to ten weeks delay before getting an answer to our telegram.

You probably know that if you are going to become a control operator for more than one repeater that you must have a separate license for each – with, I suspect, a separate license fee.

And suppose you want to have a remote base station? This means that you must file for a remote control station as well as an auxiliary link station for your home location plus the remotely controlled station license and another auxiliary link station license for the remote location. You see it is illegal to talk over the remote control station! You use one station to turn the remotely controlled station on and off, and a second station

for the up link to talk through it. Let's see, at $9 each, that comes to four extra license fees, $36. And that is going up soon, right?

With each remote control station or auxiliary link station application you have to make a complete showing – systems diagram – bands to be used – monitoring provisions – power justification – measures to protect against unauthorized access – measures to protect against unauthorized operation – provisions for shutting the system down in case of failure – means of monitoring the link – and plenty etc.

Now do you see why this nightmare seems completely insane and why we put that logo on the FCC news section of the 73 newspages? Talk about Alice in Wonderland!

Some fellows who have pushed Mr. Walker say that he has relented on the control channel aspect of the above to the extent that he might accept a system which used just one 450 MHz transmitter for both control and auxiliary link, providing that different frequencies were used for the two functions. Got that? Talk about wasting channels! So what is wrong with using the link channel for control? Only that it is not legal. It is preferable that you use two separate transmitters.

Getting back, for a moment – at our repeater site we have three separate locations around the top of the mountain – a building with a 50 foot tower – a fire tower – and a small ranger shack. All have been used for repeater receivers at one time or another. We like to try split site and see what we can do with that – then try everything at one site with antennas on the top and bottom of the tower – then in goes a diplexer for awhile. From now on each of these changes will require pounds of paper – many dollars in fees – and eons of waiting.

We're tried the G.E. Progline gear at the repeater – we've tried Motorola gear – the Standard repeater – and even the Dycomm repeater (that's a whole 'nother story – and a grim one). We've tried small experimental repeaters – repeaters made from two transceivers – repeaters on 450 – on 220 – on 52 and even on 29.68 MHz. The prospect of continuing such experiments in the future is dim indeed – we just don't have the paperwork time and the patience to wait forever for authorization. I don't think we could even hack the license fees.

No Crossband

When the crossband restriction went into effect we decided that perhaps we would then have to go the remote base route. The fact is that after trying out twenty meter sideband via a two meter link we were agonizing over its loss. How can you even begin to express the fun of sitting at the big rig, talking through a hand unit instead of a regular mike – getting up – walking out into the yard – taking a mile hike – all the time continuing the 20m contact? Or walking out, getting into the car – switching over to the car rig – driving up to a nearby mountain – getting out and taking a nice hike up the mountain for exercise, talking all the while on 20m? Once you do that for a day or two you are hooked!

So okay – new regs – we can't use 2m any more for the remote operation. We can use 450 MHz now, right? Wrong. It seems that while it is legal to remotely control the 20m station via 450 MHz, it is not legal to talk over it since this would require an auxiliary link station and that cannot be mobile – only at a fixed land location. Damnation!

And what about our plans to get 220 MHz repeaters on the air, tied in with 2m repeaters at the start to help speed the opening of the band? All gone out the window – illegal. Not many mobile operators will go the 220 MHz route now. There isn't room in most cars for both2m and 220 MHz transceivers – and the investment for two makes it worse – plus the greater chances of being ripped off. Two antennas on the car should be quite a hoodlum magnet.

Please send a note of sarcastic thanks to Mr. Walker via your senator or representative. I may be over-reacting, but this looks to me like the worst blow to amateur experimentation and development in the history of the hobby. I don't think I am over-reacting.

Six Control Ops

Now I hear that Mr. Walker has decided that a repeater should really have no more than six control operators. If any attempt is to be made to keep the repeater on 24 hours a day this means that each control operator will have to handle 28 hours each per week. That's okay for some – hard on others. And what happens when one or two are out of town on business or vacation? Then the average per week goes up to 42 hours each per week. That's a full time job!

No reason has ever been given as to why Mr. Walker wants repeaters to be turned off when there is no control operator actively monitoring. This requirement, if enforced, will require most repeaters to shut down during much of the night – and probably a good deal of the day. This means that as a safety or emergency service repeaters are going out the window.

There is no way to even estimate how many lives have been saved because repeaters have been there ready to use 24 hours a day. It is a fact that lives will be lost because of this regulation, if it is enforced. Each time such happens I suggest that those involved send a letter to Mr. Walker with copies to Barry Goldwater, ARRL, me, and President Nixon and explain that a life was lost – a loved one is dead – because Mr. Walker has insisted on asinine regulations which have no possible useful purpose.

And how many of you have run out of gas – had car trouble – or in some other way used a repeater late at night? The first time you need one badly – when some berserk gang of teenagers is chasing you down a back road and you need help and need it right now – and the repeater is off – please write about the situation and send those copies as above (if you survive).

Phone Bands

Mr. Walker's recent emasculation of the docket to expand the phone bands is another case where the work of years by many amateurs has gone down the drain – and for no apparent reason other than a whim on the part of Mr. Walker.

It was proposed to extend the 20m phone band down 50 kHz more. Any phone DXer who has been at all active in the last few years knows that this part of the band is little used and that continued lack of use will invite even more intruders. In my operations in rare spots I have noticed that the activity in the 14,150–14,200 kHz segment of the band is so low that it is difficult to make many DX contacts when operating there. As soon as I moved above 14,200 the action began – and that was not only to the U.S., but to all other areas of the world!

I realize that our Canadian friends would like to have this spot as a private preserve and that they will oppose U.S. expansion. But I think they will agree that with sideband there is little reason to have separate bands – and that virtually all DXing is done in the transceive mode these days. Most of the VEs seem to be right up there in the U.S. band when the DX is coming in anyway.

The General portion of the band is so crowded that it is often almost useless to even try to make a contact. This has come about mainly, I suspect, because all of the nets which were spread out over the band have now been compressed into half of the band. Nets must permit Generals to call in for it is the newer amateur who usually is more interested in joining them. By the time you have traffic nets, missionary nets, medical nets,

Jesuit nets, YL nets, county hunter nets, certificate nets, ad infinitum, there is little room for rag chewing.

The extra 50 kHz could have been used as incentive for Extra Class – it could have been used to allow more room for Generals – mostly it should have been used.

A Personal Decision for Me

During the last two years I've watched with growing horror as the FCC has loosed a flood of asinine regulations. I've tried to talk with the man responsible for this, Prose Walker, but found him to be virtually impervious to reason or argument. I've been distressed by this since it was my concept that Mr. Walker was a public servant and as such should be working in the interests of those whom he purportedly is serving: the amateurs and the CBers.

First there was the Eyebank docket, 19245, which stressed the importance of not handling any traffic which could be of pecuniary interest to anyone. This was a completely new concept. In the past amateurs have been able to help reporters get stories from disaster areas – call in for a South American ham and find out what happened to an ordered piece of gear – things like that where the operator involved had obviously no pecuniary interest. But the new regulations are something else. We've yet had no interpretation of them, but as written it appears that it could be against the law to report an accident since this could mean money for the wrecker or a doctor or perhaps a hospital.

Then there is the environmental protection docket 19555. Some readers thought I over-reacted on the January cover to that. But here is what Bob Booth W3PS, the legal counsel for the League, had to say about it, "The proposed rule, if adopted and applicable to the amateur service, may be the greatest threat to the continued existence and growth of the amateur radio service in the United States since the proposal following World War I to abolish amateur radio entirely."

The crowning effort of Mr. Walker is the repeater docket 18803. Now, while *I may* have *my* areas of *incompetence*, no one can honestly call me dumb. Yet, all of the efforts that I have expended toward trying to understand the new repeater rules have brought only frustration and bewilderment. The more I ask questions, the more I seem to find that not even Mr. Walker understands what he has dreamed up for us.

To me it is a fact that we had about one thousand amateur radio repeaters active in this country before 18803 and they were all living pretty much in harmony with each other. Sure, there were little problems here and there, but for the most part these had been or were being solved by regional councils of repeater operators.

Amateur ingenuity was being demonstrated to an extent without precedence in our history. I've talked from a hand unit in Las Vegas via a ham network to a mobile in Los Angeles – to another in Phoenix – another in San Diego! It worked and worked well – and it is now absolutely illegal. This does not seem sane to me.

We had more and more groups experimenting with emergency systems of communications which permitted repeaters to be connected cross band to other repeater systems – to low band systems – to the service nets on 40 meters. We were starting to try out repeaters on ten meters so that we could interconnect two meter repeaters over thousands of miles in case of emergency. All this is now illegal.

To me it is a fact that the only emergency service which can provide short, medium and long range communications is amateur radio. It is a fact for me that every time there is a serious emergency the telephone system fails and radio is all that is left. Where will we be if the primary emergency radio service, amateur

radio, has its growth stunted by severely restrictive regulations?

I know it is not only me asking these questions for when I spoke to the FM gathering at Dayton I asked for a show of hands – first I asked to see how many of those present were the actual representatives of repeaters, not just users, but the fellows who have to license them and keep them on the air – I saw over 200 hands pop up. I then asked how many of those present thought that there was any way that they could manage to live with the present regulations – not one hand went up – NOT ONE!

We all know that our country depends upon us to provide communications when we have disasters and we know that the worse the disaster, the more amateur radio is needed. With CD virtually impotent, there is no other communications system except amateur radio available for the ultimate emergency. The repeater regulations, unless changed, could lose not just a few lives now and then when a repeater is off the air for lack of a control monitor, but could lose thousands upon thousands of lives because the amateur systems that we might have to meet the emergency will never be built.

Some amateurs seem to see a sinister plan in this – a plan to kill off troublesome amateur radio and get rid of it. I don't think so. I think we are faced with one problem: Mr. Walker. I suspect that he has worked up repeater regulations to fit the amateur experience in his past – for the regulations make sense if you think of them being written for 75 meter phone repeaters. Mr. Walker had had virtually no contact with two meter FM when he wrote those rules.

The ARRL is as frustrated as I am about what is happening. They have sent McCoy to Washington to try and reason with Walker – and he has gotten nowhere. The ARRL answer was to issue the sharpest denunciation of the FCC in the history of the League – and to start the directors around to the clubs getting the word to them about Mr. Walker. I have received tapes of some of these talks and I would appreciate getting tapes of others – my friends, please note. I wish that I had the space in 73 to reprint these talks verbatim – it might shake a few more amateurs into the realization that this is not something that can be shrugged off and left to someone else.

One director recently said that our representatives in the FCC have a responsibility to listen to us and have no right to ignore us or to retreat in petulance when we try to argue against new regulations. He was talking about Mr. Walker.

I gather that I have gotten on Mr. Walker's not too favorite list – if I may be guilty of an understatement. This is unfortunate, but I could not face myself or you if I did other than try to bring reason out of the madness that has descended upon us. I have not been able to achieve any reason. I now find that there seems to be a reluctance on the part of the FCC to provide information on the latest twists and turns of divination of the entrails of docket 18803.

Rather than getting repeater licensing information from the Commission I now find that I am getting some news from this club – from that club–from repeater newsletters – talks at conventions! This seems odd to me since I have tried to have 73 be as up to date on repeater info as possible and the Commission is well aware that they can get their information to the maximum number of amateurs if they provide it to the ham magazines – including 73.

In the past I have gone to Washington and talked with Mr. Walker and brought the results of this to the repeater groups via FM symposiums, the Repeater Bulletin and through the pages of 73. This has resulted in me becoming a sort of information center – with phone calls at all times of the day and night, letters by the gross, and even long visits from repeater operators.

All this has made it more difficult for me to work on 73 Magazine and, though some readers have gotten the impression that 73 is primarily an FM magazine, the fact is that about 20% of it is so oriented – and that is about right, considering the number of amateurs involved with FM today. I really should not spend as much time on FM problems as I have.

If the situation were clarifying, I might see some end to it. But it appears to be getting worse instead of better. If there were some way to talk reason with Mr. Walker, I might be encouraged. Reason in this case not being Wayne Green's ideas, but ideas agreed upon by most repeater groups. The League has the same problem and apparently hasn't figured anything to do about it either.

I am as upset as anyone when I hear about repeater councils deciding that if the FCC is going to ignore the needs and the pleas of the repeater groups, then they are going to ignore the FCC. The example of the citizens band is brought up constantly and amateurs ask why they should have to obey stupid rules when the CBers ignore virtually all their rules. This is difficult to answer.

It seems a pity that the amateur and CB division of the FCC should choose to ignore the CB problem entirely and spend all of their time dumping on the amateurs. Mr. Walker has a serious situation on eleven meters and this is his responsibility to solve – yet he appears to have come up with absolutely nothing to help this problem.

Getting things straight at the FCC obviously is important to more than the FMers – witness all of the other rules that have been coming out, none of which are much better than the repeater regulations. Really, before we turn to anarchy, we should make a determined effort to either break through the seemingly impervious wall Mr. Walker has built around himself or else work diligently to get someone else into his job.

Now I don't know if the ARRL is going to get to first base in their effort to unseat Mr. Walker. I suspect that they would make more headway if they concentrated on informing Senator Goldwater and the senate commitee that runs the FCC of the situation than trying to stir up grass roots reaction among the member clubs as they appear to be doing. Again, this would be ideal work for that Washington lobby that we don't have. I won't belabor that point further.

If I were to drop the reins at 73 and just concentrate on solving the Walker problem, I probably could manage it. I'd see every senator on the FCC committee. I'd try to get on television wherever I could and talk up amateur radio and point with anguish at the FCC – a posture that might be most acceptable to TV stations. I think I would interest a lot more people in amateur radio in the process and I think I could get Walker out as Chief. But the fact is that until quite a few more major manufacturers advertise in 73 and clubs get their members to subscribe to the magazine, I have to work my usual 90 hour work week just to keep our head above the water.

Of course I would enjoy talking up the hobby on television – getting to conventions for talks – putting on the pressure in Washington – I get a kick out of that now. I used to be scared silly to get up in front of large groups and talk, but now I enjoy it. It's fun to get across my ideas – to make everyone laugh – to entertain. I used to freeze up and not be able to think of anything to say in front of an audience – now I'm a bit tense, but my talks are unprepared other than for a note or two and I can go on for hours at a time – I haven't heard any complaints.

It is growing increasingly obvious to me that I must stop spending so much time trying to personally do something about the FCC in Washington. The ARRL has volunteered to get this

done and I probably would do best to sit back and let them do it and tend to 73 Magazine – make it better – help get more advertising – more subscribers – better articles – things like that.

It is difficult for me not to get wrapped up in new ideas. For instance there is the Repeater Bulletin. This was originally designed as a communications medium for the New England repeater groups to help them iron out their problems. Now, with but a few instances, these problems have been solved and we have about 50 repeater groups working in wonderful harmony. Obviously there is not a lot more need for the Bulletin.

Unless some important need arises for the Repeater Bulletin I think I shall spend less time on it – perhaps continuing it every other month – and work harder on 73. I did consider for a while the possibility of making it a newsletter for all repeater operators – but then I remembered how difficult it is now to get information from the FCC – or even from repeater groups. I'm not sure that a rehash of material from repeater group newsletters would be of much value – and it is expensive enough to publish a newsletter so there should be some darned good reason before going ahead.

Yes, I know about the reincarnation of RPT from the bowels of Dycomm down in Florida – I've seen the first issue with my good old buddy Rob Waters on the cover – and there is an interview with him inside where he admits to failing at manufacturing ham gear (remember the Waters switches?) – and says he thinks that the Class E CB band on 220 will be a good thing.

A good FM magazine could make it, I think – but one put out by Waters (who is not overly popular with many FMers) – Jim Penny of Dycomm – and Art Housholder of Spectronics would not seem to have much of a chance. I remember that Will Rogers said that he never met a man he didn't like – well I try to follow this ideal no matter how difficult the above three make my resolve. Seldom in my life have I been put to a greater strain.

Through the Repeater Bulletin I've tried to show what format would make an FM magazine successful – some articles – reports from repeater groups – FCC news – and lots of opinions and ideas. Any signs that the magazine is "owned" by one or two commercial interests will, I suspect, fold it the way this did rpt---. It just looked too much as if Dycomm and Spectronics were partners in the venture to sit right with other companies. The new RPT seems to be taking the same path, with the only major article being about a charger for the Motorola HT-220 and requiring a Motorola charger that is available only from Spectronics, to the best of my knowledge.

Speaking of the 200 MHz citizens band proposition – one further digression should be imperceptible after this long series of them, so let's air my views on 220 MHz – particularly since I have been misquoted and misrepresented almost universally on this subject.

It is difficult to speak of citizens band without bringing up the spectre of the present 11m band and the chaos present. It is all too easy to equate the mess with the term CB and dismiss the idea perfunctorily. I don't think it is fair. Eleven meters is the way it is, I believe, for two reasons – bad rules and little enforcement. If rag chewing and high power were permitted on the band I doubt if you would have illegal stations, bad language and all the other miseries. I am not suggesting such, only getting at the problems.

I do believe that there is a great need for an inexpensive communications band for small businesses – something like the original CB concept. I believe that there is such a need for this that even if it is not put in the 200 MHz band it will find a place in the spectrum. Obviously then there is a question, do we have anything better to do with 220–222 MHz than put in a small business band? I think we do.

It would be dishonest to say that I think that the present amateur population will move into the 222 MHz band in sufficient numbers to crowd the band. With the recent ruling against cross band operation I feel that the development of the 222 MHz band has been stabbed in the back. Mr. Walker, again. I expect there will be some development of the band, but I think it will be slow and frustrating. We don't have enough hams licensed now to even fill up two meters, much less 222 MHz.

If we were to start thinking in terms of trying to attract newcomers to our hobby – possibly looking to the Japanese system (they have over 350,000 licensed hams today to our 265,000) for ideas – we might take a band such as 220–225 MHz and open if for a special type of new amateur license – a band where newcomers could meet and talk with amateurs and be inculcated with the amateur spirit – where they could honestly have the fun of being hams and be encouraged to join clubs and get a higher grade of license.

A real beginner's license, similar to the one used in Japan, could well attract several million new hams. We could use them. And the 220 MHz band certainly could accommodate them. Figuring that they might spend only half the amount of money presently licensed amateurs do ($400 per year average), this would mean sales of about $200 million per year for each one million hams. This could easily grow to a market of $500 million per year.

Few amateurs are interested in the market dollars involved, of course, but this is the key to getting frequencies. The spin off for hams would be a return to growth of the hobby and a lot less chance of having further troubles from men like Mr. Walker. You've noted that he doesn't do anything to anger the 1,000,000 CBers, just the 100,000 or so active amateurs.

Thus manufacturers would certainly have their small business band, though it might end up in an unused television channel, complete with the $500 million per year in sales from that bonanza – plus another $500 million from the new ham band. Maybe more.

I had this scheme in mind several years ago when I submitted a petition for using part of the 220 ham band for a hobby class of license – one which would primarily require an exam on operating techniques and regulations rather than code and theory. It seemed like a good way to get fellows started the right way.

Frankly I think it is very shortsighted of the manufacturers who are backing the EIA plan for putting the CB band on the low end of 220 MHz rather than my hobby band idea – with a separate band for small business-type CB.

Every time I pick up a hand unit and talk through a repeater I get to thinking that it is almost unfair for me to have so much fun when it is prohibited to all but the handful of people who have passed the tough ham exam. I climb up my local mountain, FMH with Waller touchtone pad gemounted in hand, and talk all over central New England – make phone calls in Boston – and I just know that this is something that could attract millions of people. Boy, if Walker knew how great a feeling it is to do that he might get rid of FM entirely!

Now, to backtrack through a few digressions, I think I'll leave Mr. Walker pretty much up to the League – and try to stop as much extraneous exercises as I can and see what I can do to get 73 into every active ham mailbox in the country. It's just too much for me to keep up with everything.

. . . W2NSD/1

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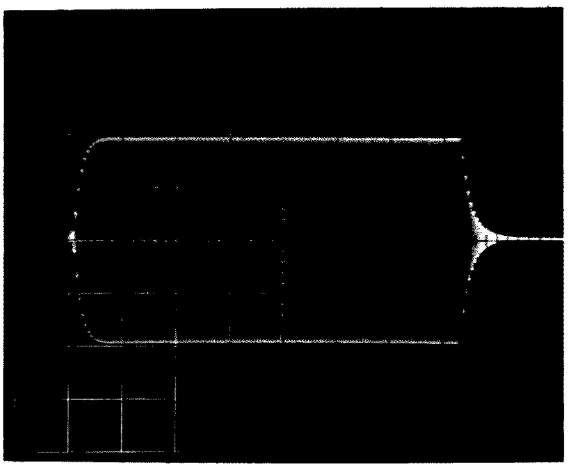
AN EXPERIMENTAL COMPARISON OF CW AUDIO FILTERS

The addition of a CW audio filter to a receiver can greatly improve its noise response and selectivity, particularly if it is an older or inexpensive model. Although homebrewers usually include such a filter in their original design, the average ham probably adds a filter to his present receiver. But which one? There have been numerous articles and circuits presented in the literature over the years. I have had more than thirty articles published on this subject alone! The object of this article is to present some of the best circuits with their test results so that hams can select the best CW audio filter for their needs.

There are several facts that must be considered when one rates the value of such a filter:

1. The bandwidth or selectivity of the filter, which determines the width and steepness of the skirts of the filter passband.
2. The slope of a keyed wave form after passing through the filter. Sharp rise and fall times yield clean, crisp signals while a slow rise and fall will ring and sound distorted.
3. The insertion loss, or gain of the filter, i.e. a comparison of the input signal to the output signal.
4. The cost and size of the components comprising the filter.
5. The power supply requirements, i.e. passive vs active filters.



Horiz — 20 ms/cm, BW=160 Hz

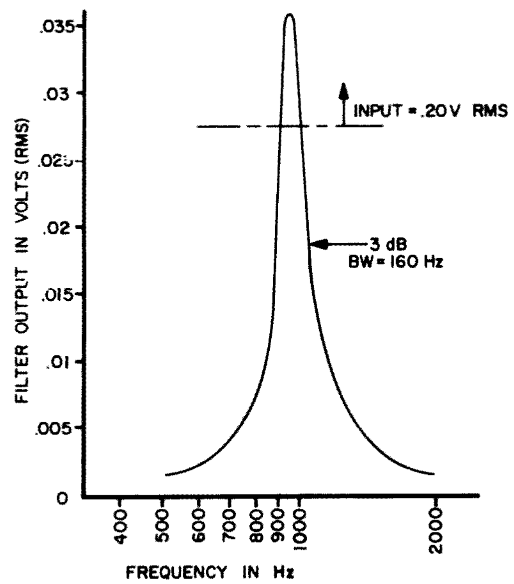


Fig. 1. Filter characteristics of the passive surplus range filter.

6. The flexibility of the filter, i.e. fixed characteristics or variable selectivity, variable frequency or both.

The surplus range filter has been used by amateurs for more than 25 years. It is passive, plugs directly into the headphone jack, and inexpensive ($2.25). The characteristics of this filter are shown in Fig. 1.

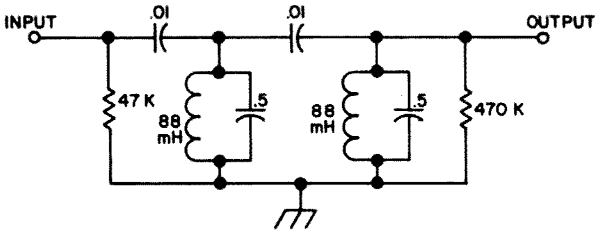
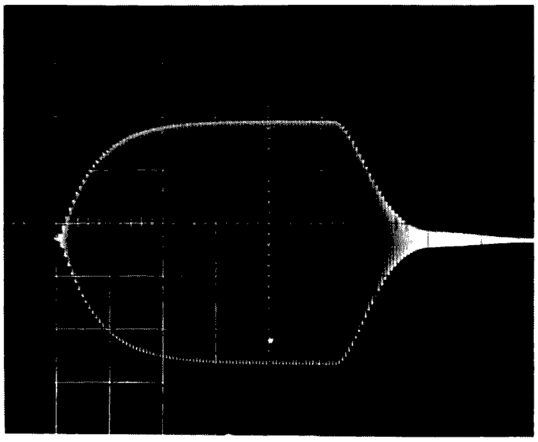


Fig. 2a. Schematic of the 88 mH toroid filter.



Horiz — 20 ms/cm, BW=35 Hz

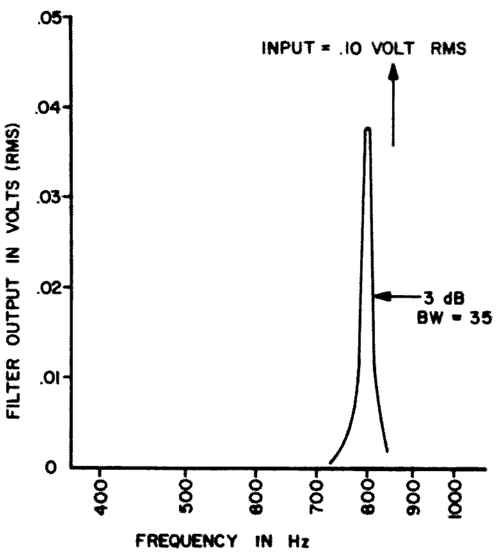
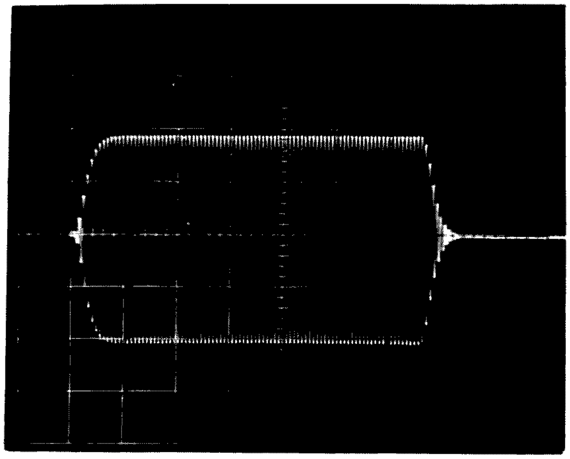


Fig. 2b. Characteristics of the passive toroid filter.



Horiz — 20 ms/cm, BW=142 Hz

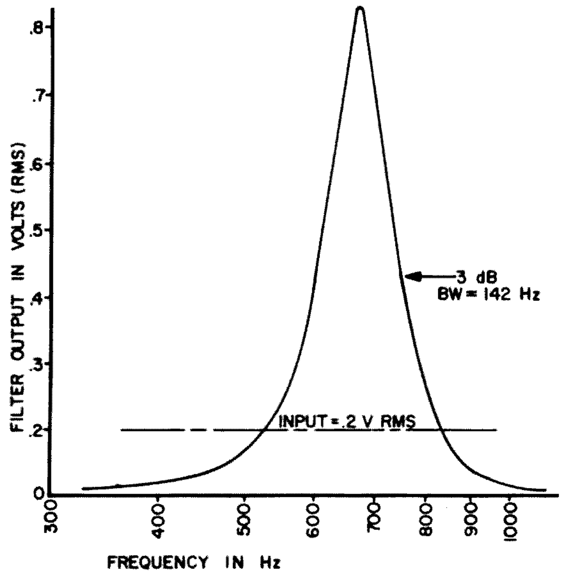


Fig. 3. Characteristics of the 4 section, Twin-T active filter (Ref. 2).

The insertion loss is high and the bandwidth fairly broad. The keyed wave form is sharp and CW signals sound good through this filter.

Figure 2b shows the filter characteristics of a passive filter design that has been popular for the past few years[1]. It uses inexpensive, surplus 88 mH toroid conductors. This filter is very sharp, 35 Hz bandwidth at 3 dB down, and it also has a high insertion loss. The keyed wave shape has a slow rise and fall so CW signals have a pronounced ringing.

Figure 3 shows the characteristics of a 4 section, twin-T, active filter[2]. This filter has been designed to provide a reasonably narrow bandwidth and a clean keyed signal.

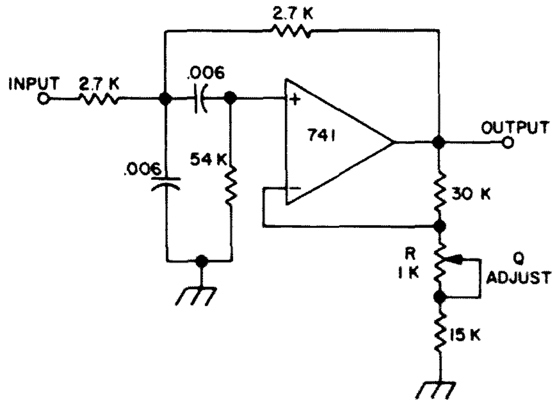
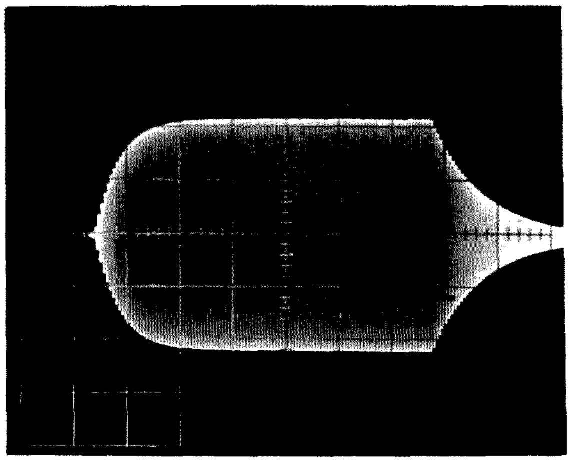


Fig. 4a. Schematic of the variable Q active filter.



Horiz — 20 ms/cm, BW=75 Hz

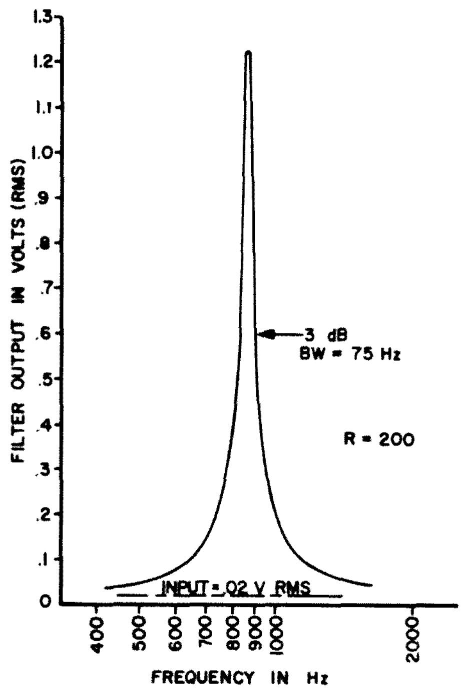


Fig. 4b. Response of the variable Q filter.

This filter provides signal gain and is fixed in frequency and selectivity. The design is fairly complex, requiring 9 transistors, 15 capacitors, and 30 resistors. CW signals sound good through this filter.

Figure 4b shows the filter characteristics of an active filter of fixed frequency but variable Q[3]. The keyed wave form is a slow rising and falling wave form, but its slope is good considering the narrow (75 Hz at 3 dB) bandwidth. The cost of the filter is low since 741 operational amplifiers are available for approximately 35¢.

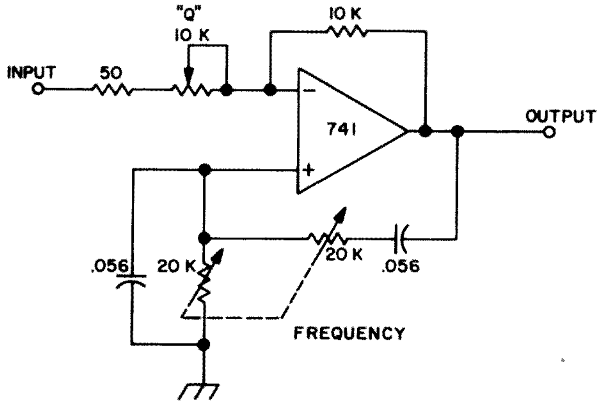
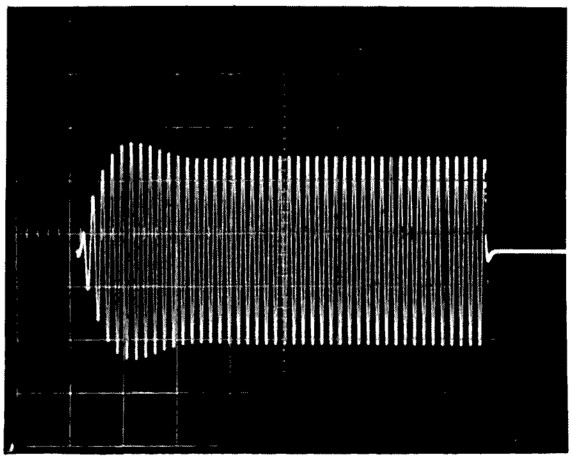
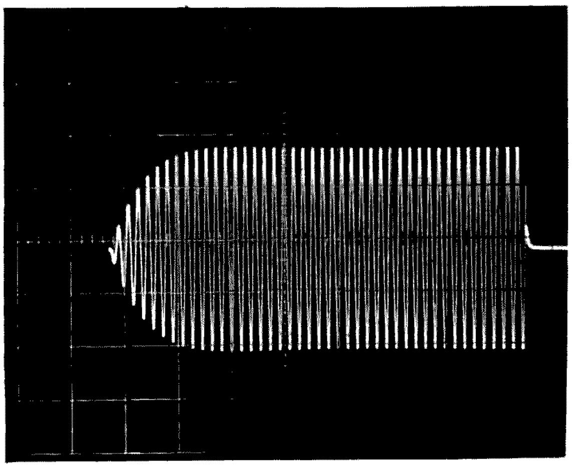


Fig. 5a. Schematic of the variable Q/frequency active filter.

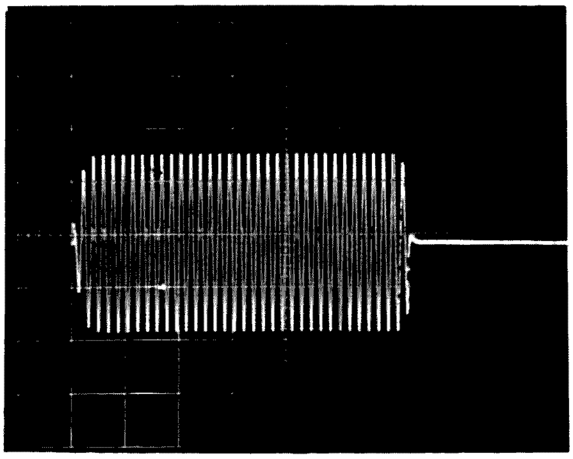


Horiz – 20 ms/cm, BW=18 Hz



Horiz – 20 ms/cm, BW=56 Hz

Figure 5 represents a single active filter that has variable selectivity and variable frequency. The bandwidth can be made extremely sharp, less than 9 Hz, or very broad, greater than 300 Hz. The keyed wave



Horiz – 20 ms/cm, BW=242 Hz

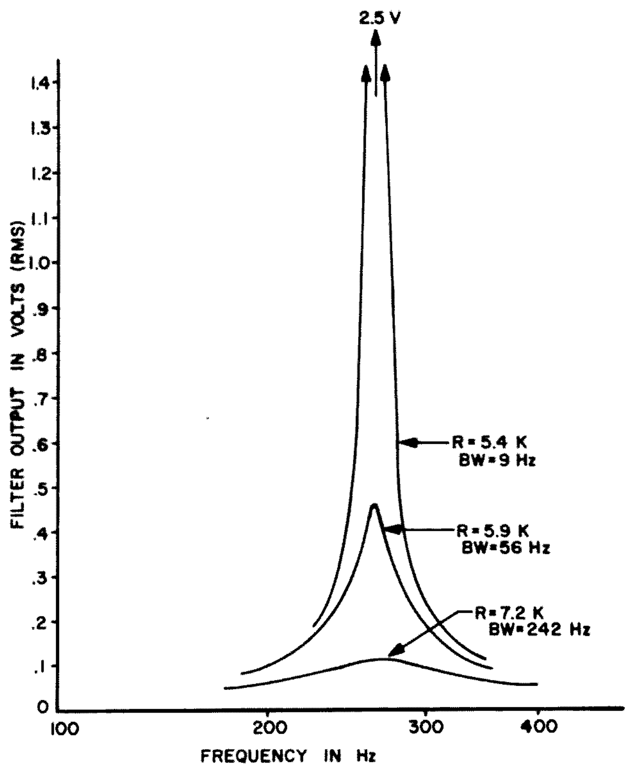


Fig. 5b. Responses of the variable Q/frequency filter at different bandwidths.

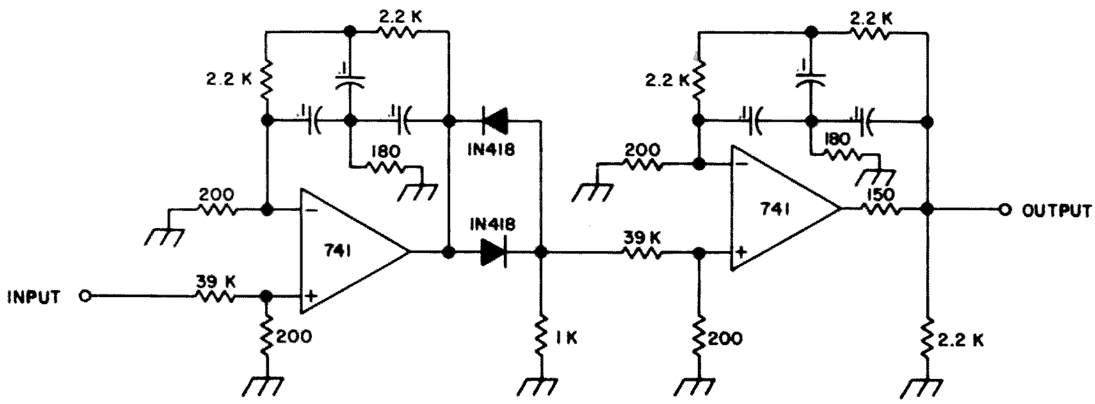
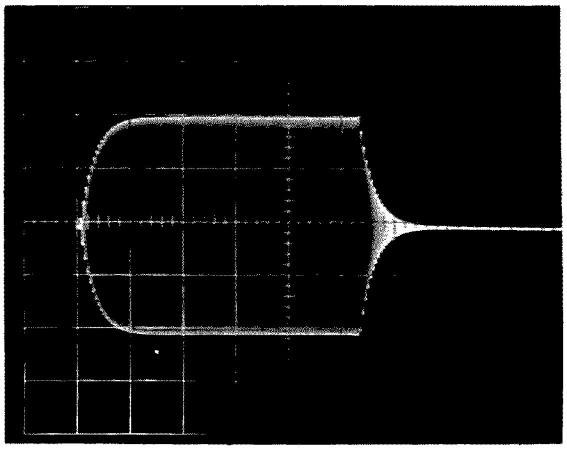


Fig. 6a. Schematic of the two stage active filter with a threshold detector between stages.



Horiz — 20 ms/cm, BW=16 Hz

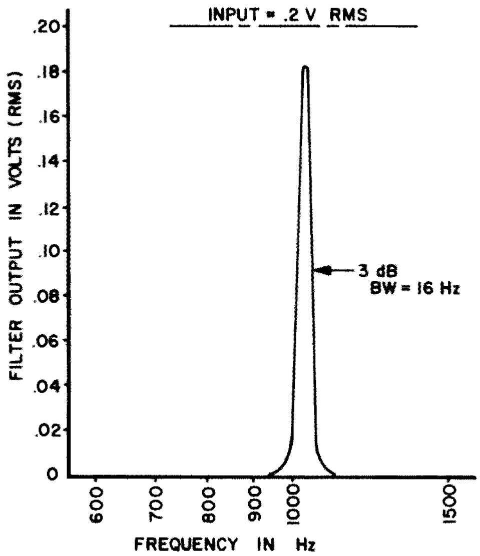


Fig. 6b. Response of filter with threshold detector.

forms are particularly sharp, considering the narrow bandwidths. The overshoot at a bandwidth of 56 Hz should not be objectionable. The gain of this filter is strongly dependent upon the Q setting, requiring the operator to adjust gain, unless the filter is followed by an audio stage with automatic gain control.

The data shown in Fig. 6b is for a two stage active filter with a diode threshold detector between stages.[5] The diodes prevent low signals (such as QRN) from passing through until the CW signal of the desired frequency is present, which provides quiet tuning between signals. The bandwidth of this filter is sharp (16 Hz) and the keyed wave form is good for this extreme bandwidth. Signals through this filter do ring somewhat and an interchange of capacitors to obtain a slight mismatch and broaden the bandwidth would help. The gain of this filter is near unity, and the frequency and Q are fixed.

I hope this discussion will help in the selection of the most suitable filter for your application.

. . .W6AGX

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1. McCoy, L.G., "The Selectoroid, A Simple High Performance Audio Filter," *QST*, Dec. 1966.

2. *The Radio Amateur's Handbook*, 1971 edition, "An Active Filter," pp. 131–132.

3. Russell, H.T., "Single Amplifier Active Filters Give Stable Q," *EDN/EEE* Jan. 1, 1972.

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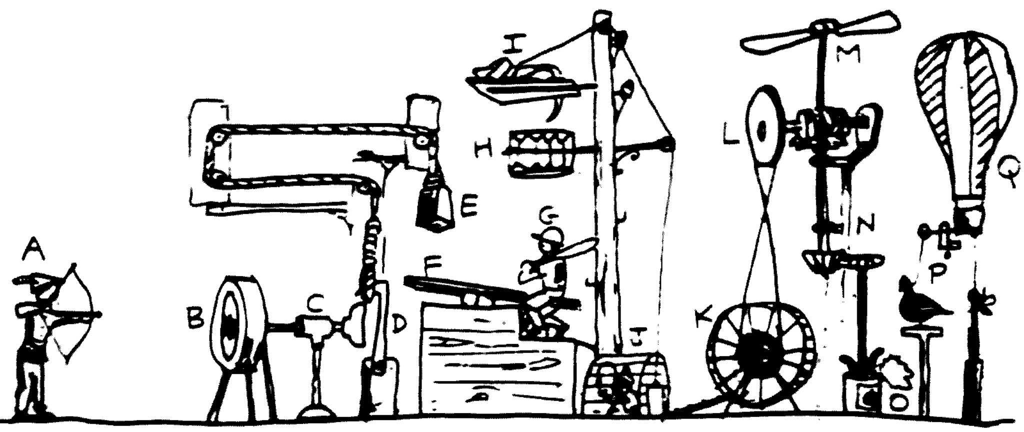
U.S. Patient Office

Concerning: A System To Achieve 85 dB Gain On A 2M Antenna



Archer (A) shoots arrow into bullseye of target (B), pushing plunger (C) and releasing noose from latch (D). Weight (E) drops onto south end of see-saw (F), catapulting designated hitter (G) from the north end. Bean-proof hard hat hits bottom of bass drum (H), waking sleeping dachshund (I) who jumps up raising door on cage (J) containing overweight squirrel Squirrel, following the veterinary's orders, jogs eagerly up the ramp into exercise wheel (K), turning pulley and gears (L). This rotates cooling fan (M) — a valuable side effect in summer months but annoying in the winter — and turns worm gear (N), stirring up a whole can of worms (O). Partridge (P) lunges at rising worms, pulling pin and releasing hot air balloon (Q), which raises antenna gain to a cool 85 dB (see M)

Fantastic Breakthrough!

The following article describes how to make a mobile two meter antenna with a measured gain of 85 dB! Yes, that's right, eighty-five dB gain.

This antenna results from my need for a high gain mobile antenna to go with a not too sensitive mobile rig. After much experimentation, machine shop work, and exhaustive lab testing, the following antenna emerged.

Construction should take only one evening and the parts should not be difficult to get. The instructions should be followed closely if optimum results are to be achieved.

The base of the antenna is an SO-239 connector. To this, four 50.80 cm copper radials are soldered into the holes provided in the SO-239. Care should be taken to see that a good ground connection is made to the body of the connector. Now the main radiator can be fabricated out of the same material (#10 wire does nicely), the length of the radiator being 46.99 cm. The element

should be soldered securely to the center pin of the SO-239 and be perpendicular to the radials.

SWR measurements can be made and the SWR adjusted by changing the angle of the radials to the body of the SO-239 and trimming the main radiator if necessary. The antenna was fabricated and taped to a wooden stick attached to my car in order to make the following gain measurements.

The output of my Hewlett Packard model 608A signal generator was connected to an antenna and a signal level set into the mobile receiver. The gain antenna was connected to the mobile at this time. The gain antenna was removed and a lab quality 50Ω load installed in its place. The signal generator output was raised to achieve the same signal level as before. The signal level out of the generator had to be raised 85 dB to get the same reference level in the mobile now with the 50Ω load connected. This proved that the gain antenna has a 85 dB gain over the 50Ω load. What? You thought that it was gain over a dipole, or was it over a quarter wave whip, or was it over an isotropic radiator, or was it over . . . ?

All too often this is the case. Gain figures are bandied about without telling what they refer to. Think of the term "dB gain" as meaning "more gain THAN." More gain than what? Do they tell you? Is this "system gain?" Is this power gain or voltage gain? These questions should be asked when you are told "This antenna has – – dB gain."

Dr. John D. Kraus in his Book, "Antennas," *McGraw Hill,* 1950, says, "Gain is always measured with respect to some reference antenna. Since an isotropic source is a hypothetical standard, it is common practice to make actual gain measurement with respect to a 1/2 wave reference antenna."

Unfortunately this is not always the case, especially in the ham antenna field. Some manufacturers rate their antennas over an isotropic source, while others rate them over a ground plane and others may even rate theirs over a 50Ω load! There is no agreed upon standard.

Let's look at the various standards and compare them to one another.

An isotropic source is often used as it gives the highest gain figures, i.e., a 1/2 wave dipole has a 2.15 dB gain over an isotropic source (this is not the reason that *all* manufacturers use isotropic source as a standard, but the reason that *some* do). For all practical purposes, let's say that an isotropic source has the lowest gain figures, highest numbers, of any antenna standard that radiates efficiently. An isotropic source exists only in theory. It is a point source, infinitely small, that radiates equally well in all directions of all planes. Think of the sun as an isotropic source radiating light in all directions throughout space.

A dipole, on the other hand, has directivity – therefore gain. If you put the same amount of power into a 1/2 wave dipole and all of it radiates, and you put the same amount of power into an isotropic source and all of it radiates, you will get more signal broadside off the dipole than from the isotropic source. You will get less signal from the ends of the dipole than from the isotropic source. A dipole has 2.15 dB gain over an isotropic source. 2.15 dB is equal to increasing the power 1.64 times. Another way to say this is an isotropic source with 164W will be equally as strong as a 1/2 wave dipole with 100W in the dipole's best direction. Of course, the same dipole will be much weaker than the isotropic source off the ends of the dipole.

A quarter wave whip is sometimes used as a standard. There is no exact measurement of the gain of a quarter wave whip. It depends on the size of the ground plane and the height above ground. The Electronic Industries Association Subcommittee has agreed that a quarter wave whip mounted on a ground plane 137 cm square and 152 cm off the ground, operated in the 150 MHz band has +1½ dB gain over a 1/2 wave dipole. Related to an isotropic source this is +.65 dB gain.

Some manufacturers, in order to play the numbers game, speak of voltage gain at the receiver. A receiver connected to a 1/2 wave dipole will have a voltage gain of 4.3 dB over one connected to the imaginary isotropic source (2.15 dB X 2 = 4.3 dB voltage gain). Voltage gain as expressed in dB is twice that of power gain in dB. For example, to double the power is to increase it 3 dB. To double the voltage is to increase it 6 dB. To increase

the power ten times is 10 dB. To increase the voltage ten times is 20 dB. Voltage gain can be used if a manufacturer wants to show large "dB numbers."

Another popular numbers game is to talk of "system gain." Add the dB gain of the two antennas together, one on each end of the circuit, and a dipole now has a system power gain of 4.3 dB over an isotropic source. It has 8.6 dB gain if we start talking of system voltage gain. Remember that this 8.6 dB gain is the gain of a *dipole*! Just think of the numbers that we could come up with for, say, a yagi.

One popular 5/8 wave antenna on the market claims 3.7 dB gain (3.65 dB rounded off) over an isotropic source. This comes to 1.5 dB over a 1/2 wave dipole, and you will only realize that if you mount the antenna 1/2 wave above a ground plane. The 1/2 wave support pipe acts as part of the antenna to give that additional 1.5 dB gain. If you don't mount it on a meter-long pipe on your car (and who does) it's only a 1/2 wave dipole with 0 dB gain over a 1/2 wave dipole. This acts much like the coaxial antenna where the whip portion is one half of the antenna and the 1/4 wavelength sleeve is the other half. A coaxial antenna has a gain approaching that of the 1/2 wave dipole it electrically resembles.

These large differences in gain measurement are one of the reasons the FCC has required amateurs under the new repeater rules to know what gain their antennas actually produce.

As a rule of thumb, a given antenna will give equal gain as an antenna of similar size if both are of good design. Don't be misled by SWR as a measure of antenna efficiency. Remember that a 50Ω load loads well and has an excellent SWR, but does not radiate well. The gain of an antenna is directly related to its size. You will not get 16 dB gain from a four foot vertical two meter antenna unless its gain is related to a piece of wet string. Beware of small antennas that have big gain figures.

So the next time one of your friends, or even an enemy, tells you that his Super Wave Grabber has 14 dB gain, ask him, "14 dB over what?"

...K1TKJ

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COMPROMISE MULTIBAND ANTENNAS

Ideas on antennas to use for the "impossible QTH"

Many amateurs, even when living in private houses, encounter very difficult antenna installation situations. For instance, supposing one has available only a single elevated point to which an antenna can be attached, one desires multiband operation, there is no direct ground connection available at this point and one desires a reasonably small and inexpensive antenna structure.

It is assumed that one has tried a random length wire or other antenna form near the ground and found it unsatisfactory for reasons of performance or because of TVI or BCI problems. There have been many antenna forms developed to satisfy the above difficult installation conditions and their designs have ranged all the way from high quality trap or loaded designs (correspondingly expensive) to fanciful "magic" designs where full details of construction are not made public.

This article does not describe any "magic" type of antenna but rather tries to go through a brief analysis of the various antennas that one might consider for use under the conditions stated and which can be simply home built and provide reasonable performance. The form of antenna finally arrived at is a triangular loop with some special matching baluns. However, that is getting somewhat ahead of the story and one should first become acquainted with some of the considerations involved with other antenna forms under the installation conditions that are postulated.

Remembering the installation conditions and assuming that trap or loaded designs are not considered because of their constructional difficulty, tuning requirements, etc., the first antenna form one might consider is a short dipole.

Short Dipole

By a short dipole is meant one that is less than a ½λ long. For instance one might have a ½λ long dipole on 10 or 15 meters and then consider operating it on the lower frequency bands where it becomes a ¼ or even 1/8λ long dipole. Naturally, the feed point impedance of the dipole on the lower bands will no longer match the coaxial feedline to the dipole and a definite swr will exist on the line. Perhaps one question that

should be explored immediately, since some compromises are going to be necessary in the antenna design used, is the effect of swr on the line and how much swr can be tolerated. If the antenna/feedline system is a balanced one where a balun is used to go from a balanced antenna form to an unbalanced coaxial transmission line, the line is run for a reasonable distance at right angles to the antenna plane, etc.; the power reflected back from the antenna which it won't accept because of the feedline/antenna impedance mismatch will be dissipated mainly as a heat loss. This heat loss will occur in the line and in the matching network used between the transmitter and the line. Only a small amount of loss will occur because of radiation from the line.

So swr on the line need not necessarily be a cause for worry regarding TVI and BCI generated by excessive line radiation. The main compromise that one has to accept is regarding how much transmitter output power it can be tolerated to have lost via heat loss. The exact loss accumulated with any given type of transmission line and under any given swr condition can be found in antenna manuals. Figure 1 gives a brief summary of the losses that can occur under some typical conditions. For instance, if one used 30m of RG 58/U cable and the line had a 10:1 swr, the total loss would be 6.5 dB. In other words, slightly less than 25% of the transmitter power would be accepted by the antenna for radiation. If RG 8 were used, the total loss would be 2.8 dB or slightly over half the transmitter output power would be accepted by the antenna. The advantage of larger, low loss cable, if one can afford it, is apparent when dealing with a line having a high swr. For instance, if a 30m RG8/U line has a 5:1 swr, its total loss is only 1.7 dB which means that about 2/3 of the transmitter output power still reaches the antenna. This loss may be quite

Loss for 30m of cable at 20 MHz		Additional loss for 10:1 swr	Additional loss for 5:1 swr
RG 58/U	2.5 dB	4	2
RG 59/U	1.5	3	1.5
RG 8/U	0.8	2	0.9

Fig. 1. Transmission line losses alone and additional loss for swr's of 10:1 and 5:1.

acceptable if it means that one can operate on several bands with a compromise antenna.

To return to the short dipole, one can find the input impedance of such an antenna described in great detail for various lengths of dipoles in many engineering texts. When the dipole is a ½λ long, its impedance is between 50 and 70Ω, depending upon height above ground and the size of the tubing used (a dipole constructed of tubing and supported in the middle is assumed). When the same dipole is used on a lower frequency band, where its total length becomes ¼λ, the input impedance rises to about 800Ω. Used on a still lower band, where the total length is 1/8λ, the impedance becomes about 1300Ω. These input impedances are also highly reactive. Obviously the direct connection of a coaxial line to such an antenna would produce excessive swr's if the antenna were operated on some band where its total length was less than ½λ. One idea that might be explored is the use of a reverse type of 1.4 balun. That is, step down the impedance by a factor of 4 on each band including the band on which the dipole is ½λ long. Theoretically, this should produce an swr of from 4 to 5:1 on each band, but in practice it is doubtful if any balun will function properly with the highly reactive impedance present. Also, the performance on the band where the dipole is ½λ long is compromised. The short dipole, as such, constructed from tubing, would appear to be a poor solution to the compromise antenna problem. The only exception would be if the dipole could be constructed sufficiently large from sheet metal or tubing to form a broad-band bow-tie type dipole. However, this would require considerable mechanical effort.

Short Vertical Antenna

The short vertical antenna deserves brief mention because it has frequently been accepted as a compromise multi-band antenna for military applications. But usually a good ground system has been available, and under such a condition the use of such an antenna is feasible. A good example is shipboard usage with steel-hulled vessels. Some amateurs may have come across sur-

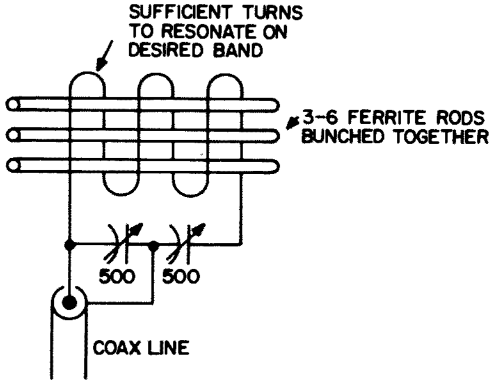

Fig. 2. Ferrite loop antenna for single band operation.

plus AN/BRA-6 tuners which belonged to a standby HF antenna system. A vertical antenna (unloaded) of some 5–7m in length was connected directly to a coaxial cable, when possible of up to RG 17/U size, and the tuner used at the end of the coaxial cable run next to the shipboard transmitter. Such a system was feasible since if one looks at the base impedance of a vertical antenna it will be found to vary from about 30Ω when the antenna is ¼λ at the operating frequency, to 10Ω when the antenna is 3/8λ long, to somewhat less than 5Ω when the antenna was 1/16λ long. So, even as a short vertical, the antenna did not produce swr's of much more than 10:1 on the transmission line. The overall result was that with an inherently low-loss transmission line, a good portion of the transmitter power was accepted by the vertical radiator which in itself, since no base tuning or loading was involved, could be temporarily clamped to any elevated portion of the ship's structure.

If one does indeed have a very good ground system that is large enough to be effective (¼λ or longer) even on the lower frequency bands, a remotely tuned, non-base loaded vertical is a good compromise antenna to consider. A tin sheeted roof, for instance, might provide such a ground. However, if one does not have an adequate ground, the vertical with short radials will not work any better than a short dipole. The only type of vertical that might be satisfactory without a ground system is one ½λ long. Such an antenna is not physically feasible normally on the lower frequency bands.

Loop Antennas

A loop antenna is not normally thought of being much of a transmitting antenna, except in its larger forms when it is the size of a Quad element. Some designs using small loops for the frequency of operation involved have been developed for military purposes where a high angle of radiation was desired and the loop used as a field antenna located close to the ground. In this case, the loop was resonated for each particular operating frequency using a tuning network located at the base of the loop. Some twenty odd years ago some amateurs experimented with extremely small loops (on the order of 60 cm diameter) for apartment type usage as transmitting antenna. Such experimentation continues even today. Several European amateur magazines have described ferrite stick loop antennas, such as shown in Fig. 2, for use as transmitting loops for difficult antenna locations. Such loops are tuned for operation on one band only, although of course they can be bandswitched once the constants for each band have been found by experimentation. The capacitor divider network shown on the loop in Fig. 2 is used to resonate the loop on the operating frequency for maximum output while at the same time using the variable capacitance divider to match the impedance of the coaxial feedline for a 1:1 swr.

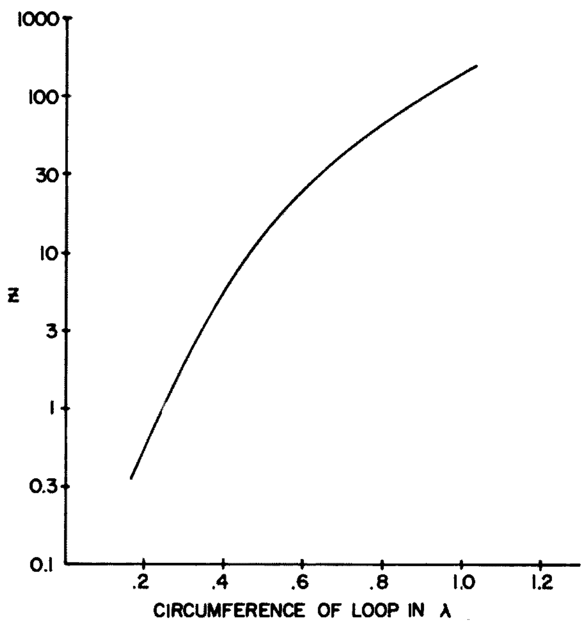

Fig. 3. Radiation resistance of a loop as a function of its size.

TECHNICAL AID GROUP

The Technical Aid Group is a group of hams who have indicated a willingness to share their knowledge and skills with others. They have volunteered to be of service to fellow hams and do so without compensation. If you have a technical question, look over the list to see who has competency in the area of your question. For many of the TAG members, descriptions of all areas of expertise would be lengthy, so an abbreviated description is given. When stating your problem, give as much information as possible and clearly state the difficulty. Enclose a SASE for reply.

For those hams who have a desire to share, the TAG is the thing for you. Send a brief note requesting the membership form, fill it in and send it back. It asks a few questions about your qualifications, and there is a check-list to indicate your fields of competence. These cover all modes currently used by hams, antenna design and theory, transmitter and receiver design for HF, VHF, and UHF, logic, ICs, general help, and other areas. As more members are added, their names and addresses will be published.

Robert Perlman WB2VRW, 3 Josten Place, Hudson NY 12534. Electrical engineering student. Will help with Novice transmitters and receivers, and any help for beginning hams.

Thomas Laffin W1FJE, Box 133, Hillsboro NH 03244. Radio communications technician. Special aid to ex-CBers and those who need terms in easily understood terms; aid to Novices and Techs interested in MARS, RACES, CD, and CAP; how to build and scrounge parts; assistance on ham history, ATV, microwave, and general help.

Theodore Cohen W4UMF, 8603 Conover Pl., Alexandria VA 22308. Geophysicist. Specially prepared to answer questions about SSTV and ATV.

J. Bradley Flippin K6HPR, 116 Montecito Ave., Apt. M., Monterey CA 93940. Electronic engineer. Help with RTTY, data processing and programming, general.

Ira Kavaler WA2ZIR, P.O. Box 54, Flatbush Sta., Brooklyn NY 11226. Electrical engineer. Assistance offered in theoretical aspects of electricity and electronics from dc to UHF, design of equipment, computer programming, and signal circuit (failsafe) design.

John Teich WB2JAE/6 Ruddock, Cal Tech, Pasadena CA 91109. Novice and rig problems, solid state and logic circuitry.

David Felt WB6ALF, P.O. Box 261, Sierra Madre CA 91024. Electronics engineer. Qualified help in logic, digital and analog design, solid state, AM and TV.

Robert Groh WA2CKY, 65 Roxborough Rd., Rochester NY 14619. Communications engineer. Bob can lend a hand in HF and VHF transmitter and receiver design as well as solid-state logic and digital techniques.

Carl Miller WA6ZHT, 334 Paragon Ave., Stockton CA 95207. Computer technician. Carl's specialty area is solid-state QRP.

George Daughters WB6AIG, 1560 Klamath Dr., Sunnyvale CA 94087. Research associate. HF transmitter and receiver, SSB, and solid state, are George's fields.

D. Hausman VE3BUE, 267 Northcrest Pl , Waterloo, Ontario, Canada. Student. Novice transmitter and receiver problems as well as logic, digital techniques and ICs.

Hugh Wells W6WTU, 1411 18th St., Manhattan Beach CA 90226. Electronics instructor. Hugh can help with AM, Novice problems, VHF-UHF receivers and converters, solid state, test equipment, FM and repeaters, and general help.

Charles Hill WA7LQO, 4005 Campbell St., Baker OR 97814. Student. TV, Novice transmitter problems, and logic.

John Perhay WAØDGW. Route 4, Owatonna MN 55060. EE technician. John will help with RTTY, AM, SSB, Novice gear, HF transmitters and receivers, solid state, ICs, and test equipment.

Ron Thomas W8QYR/6, 1928 S. Beverly Glen Blvd., Apt. 12, Los Angeles CA 90025, tel. 556-2721. Commercial communications experience. Ron is willing to assist with beginners' problems, theory and regulations.

Jim Jindrick WA9QYC, 801 Florence Ave., Racine WI 53402. Consulting engineer. General help as well as HF, VHF, and UHF antennas, transmitters, and receivers.

William Welsh W6DDB, 2814 Empire Ave., Burbank CA 91504. Electronic engineer. Beginner's problems, code instruction, theory and regulations.

Ken Knecht W2GYF, Box 39, Clintondale NY 12515. Televsion engineer. TV video, logic, and digital techniques.

Tom O'Hara W6ORG, 10253 E. Nadine St., Temple City CA 91780. Communications engineer. RTTY, TV, AM, SSB, VHF antennas, transmitters and receivers for HF through UHF, solid state, and general help.

Bruce Creighton WA5JVL, 2517 Metairie Ct., Metairie LA 70002. Electrical engineer. Antennas, Novice problems, solid state, logic, digital techniques, test equipment, and general help.

Tom Borok WB2PFY 215-33 23 Rd., Bayside NY 11360. Student. Tom is especially qualified to help Novices with their problems with transmitters and receivers, HF and VHF antennas, HF receivers, test equipment, and surplus, Morse code instruction.

Roger Taylor K9ALD, 2811 William St., Champaign IL 61820. Engineer. Roger is adept with AM, SSB, antennas, solid state, logic and digital techniques, ICs, test equipment, and other general help.

Orris Grefsheim WA6UYD, 1427 W. Park St., Lodi CA 95240. TV technician. Orris is capable of assisting in all fields of amateur work, DC through UHF, logic as well as Novice help.

John Allen K1FWF, 112 Edgemoor Lane, Ithaca NY 14850. Technical director. John's areas of assistance are VHF and UHF antennas, receivers, and transmitters, solid state and digital techniques. ICs, and SSB.

Eugene Fleming WØHMK, 1327 Prairie Rd., Colorado Springs CO 80909. Radio and television repair experience. Eugene will be glad to help with HF transmitters, receivers and test equipment. In addition to letters, he will accept open reel tape and braille correspondence.

Roger A. Baim WB9BDP, 2753 W. Coyle, Chicago IL 60645. Electrical engineer. Roger conducts Novice and General Class code and theory courses and will be happy to assist those seeking licenses.

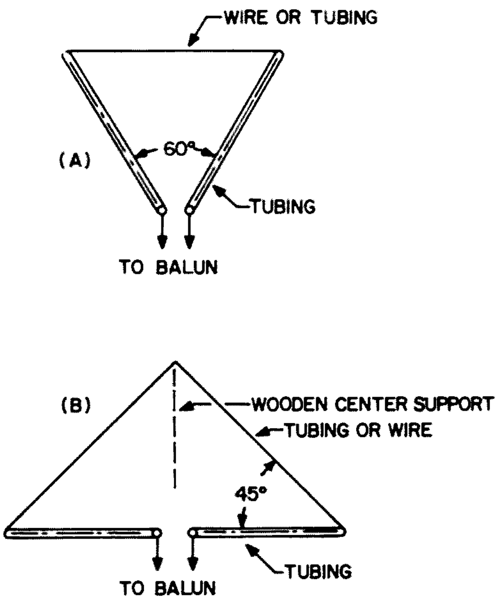

Fig. 4. The forms of triangular loops which lend themselves to single point support at the base.

Such miniature loops work to a degree but no one will deny that they are extremely inefficient. If, however, one starts to investigate the loop possibilities somewhere between those of the quad size loop and a miniature loop, some interesting results occur. For instance, Fig. 3 is a plot of the impedance of a loop as a function of its circumference in wavelengths. The impedance for a loop less than a wavelength in circumference is approximately equal to:

$$197 \times (\text{Circumference in } \lambda)^4$$

The impedance falls off very rapidly as the size of the loop becomes small in terms of wavelengths. But, nonetheless, the values themselves do remain within manageable limits if the loop is not made extremely small.

There are many designs that one can develop from the loop antenna idea if one studies the chart and some of the impedance matching transformers described later. For instance, a "loop" using the forms of Fig. 4(A) or (B) and having a total circumference of from 9 to 12m are quite feasible using a combination of aluminum tubing and heavy wire construction. Such a loop on 15 meters will have a circumference of about a .75 wavelength and hence an impedance of about 40Ω. On 20 meters it is about .5λ with an impedance of 12Ω. On 40 meters the circumference is .25λ with an impedance of about 1–2Ω.

Feeding such a loop with a coaxial line directly (but through a balun for symmetry) would not produce an intolerable swr on 15 or 20 meters but there would hardly be too much hope of any performance on 40 meters. Since a balun has to be used anyway, it would be better to raise the impedance of the loop by a fixed factor to provide a somewhat better match on 40 meters. For instance, if all impedance levels were raised by a factor of four, the 15 meter impedance would be 160Ω, the 20 meter impedance 48Ω and the 40 meter impedance 4–8Ω. The 15 meter swr still remains tolerable, the 20 meter matching has been considerably improved, and at least there is a better chance of getting some power into the antenna on 40 meters.

The method to accomplish these impedance changes is a little bit different than the usual 4:1 balun which goes from say 50Ω unbalanced to 200Ω balanced. Here we would like to raise the balanced (antenna) impedance while going from a balanced to unbalanced condition. This can be done by using either one or two standard toroid balun kits but wound as shown in Fig. 5. What is done is that the balanced load (antenna) is first transformed to an unbalanced load by one toroid winding. Then a 4 times unbalanced to unbalanced step-up

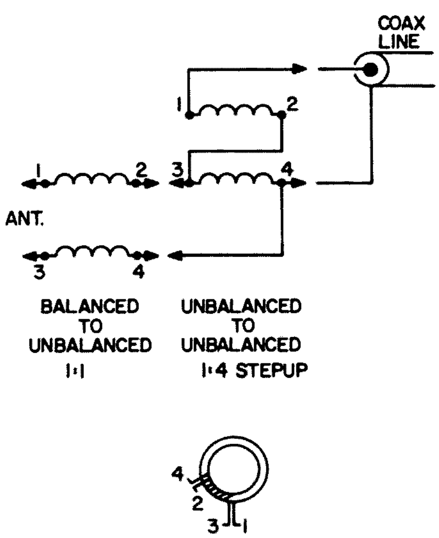

Fig. 5. Two baluns are required. Each can be wound on half of a toroid or on two separate toroids.

toroid winding is used to go into the coaxial line. The two windings may be placed on one toroid core by having each winding occupy half of the core or separate cores may be used.

The low base impedance of this type of antenna allows construction to be simplified since the base insulator need not be a good RF insulating material. For instance, if the antenna form of Fig. 4(A) is constructed by having each of the V arms being a length of TV mast or other tubing, the base plate where they come together can be a hard wooden board to which they are bolted.

Theoretically the efficiency of such a loop antenna, except for the line losses, can be quite high since it is dependent on the ratio of the ohmic losses of the antenna structure to the impedance on each band.

If the antenna structure is constructed carefully such that the ohmic loss is a small fraction of an ohm, one can even expect that on 40 meters most of the power accepted by the antenna will be radiated. In practice, of course, the theoretical efficiency is never achieved for a number of reasons. The baluns do not function exactly as desired with low impedance loads, the bonding between antenna sections will invariably introduce some ohmic loss, etc. Nonetheless, the antenna will radiate and definitely get some signal coupled into space from hopefully an elevated position from which it can do some good.

As was mentioned before, one can determine various other small loop designs, depending upon the space available to construct the loop and the bands on which one wants to operate.

Transmission Line Tuner

A tuner is invariably required in the transmission line if one is going to accept a coaxial line operating with a high swr. Some transmitters will accept and load into coaxial lines directly which have a high swr. This is particularly true for some low-power Novice class designs but is generally not true for the usual SSB transceiver which will not tolerate a line swr of over 2:1. Usually, however, one also has to use a low pass filter in the line after the transmitter to eliminate TVI problems. Such filters if they are to operate properly and provide their design harmonic attention must be operated in a "flat" line.

There are various forms of tuners that one can find described in the various handbooks and magazines. I have used the design of Fig. 6 very successfully with a number of experimental antenna designs and with coaxial lines operating at high swr's. It is the familiar "trans-match" design. Extra capacity has to be added across the terminals "XX" for use on 40 and 80 meters. The exact value depends on the impedance being matched and will vary from 100–500 pF. Another variable capacitor in series with the output is sometimes shown with this design coupler but I have rarely found it to be absolutely necessary if the coil tap point is carefully adjusted. The variable capacitor is set at maximum to start the tuning process and the coil tap point, using the minimum amount of inductance found which produces the minimum swr on an swr meter located between the transmitter and the tuner (the transmitter was initially tuned up using a dummy load). The variable capacitor is then tuned to further lower the swr and the process repeated until the lowest possible swr is obtained. As a final check, a field-strength meter should be used to check that the coil tap position used also provides the best field strengths.

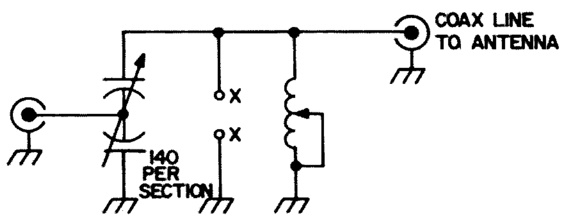

Fig. 6. Simple transmission line tuner to couple coax line operating at a high swr into a transmitter requiring 50–70Ω load at a low swr.

Summary

Under the initital environmental and constructional restraints stated, a small loop appears to offer the best chance of achieving a degree of satisfactory multi-band operation until a more sophisticated multi-band antenna can be installed. The charts and example presented should allow one to arrive at a design which satisfies almost any immediate need.

. . .W2EEY

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SSTV FOCUS/DEFLECTION COIL KIT for K7YZZ 1¼"Plumbicon type camera circuit (re. 73 Magazine, Sept. 72) complete with reprint article. $19.95 postpaid in U.S. and Canada. Also fast scan 1¼" coil kits as well as many other SSTV kits, parts and plans. See regular ad elsewhere in magazine. Write or phone for free catalog. ATV RESEARCH, 1301 N. Broadway, Dept. 73C, Dakota City, Nebr. 68731.

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DELMARVA HAMFEST, August 19, 1973. Harrington Fairgrounds. Registration fee $2 advance, $3 at the gate. For information, write Delmarva Hamfest, Inc., Route 2, Box 90, Laurel, Delaware 19956.

FOUNDATION FOR AMATEUR RADIO annual Hamfest Sunday 21 October 1973 at Gaithersburg, Maryland Fairgrounds.

GREATER INDIANAPOLIS HAMFEST, August 12, 1973, Gas Co. Recreational Area, 2 miles east of Emerson Ave., on Thompson Rd., P.O. Box 19449, Indianapolis, Ind. 46219.

COMPLETE SET: 73 Magazine, Volume 1, Number 1 to Present, $100 plus postage. Arthur E. Boyers, 719 Randolph, Topeka, Kansas 66606.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾/m	$255
Digital Logiclocks	$80
Midland 13509 220 xcvr	$200
Midland 1520 hand-held 2 meter	$190
SBE 450 450 xcvr	$340
Clegg 27B 2m xcvr	$380
Dycomm 2m repeater	$425
Standard repeater	$550
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Wilson 6 el. 20m beam (pick-up only)	$250
Wilson 7 el. 15m beam (pick-up only)	$250

RARE BARGAIN! 500 milliamp RF meter with 12 watt 50 ohm dummy, 9.50. 3, 10, 0r 15 amp RF, very few, act fast, at 3.75. Remit Money Order or bank check. Shipped postpaid. SSTV, P7, 5 to 10 inch electromagnetic and electrostatic focus, 13.50 to 26.00. 16¢ SASE complete specs, prices all types. Lotz W5HCO, 750 Florida Blvd., New Orleans, La. 70124.

REWARD for information leading to recovery of stolen YAESU FT-101 s/n82G12279/CW, 1.8 MHz, CW filter installed; REGENCY HR-2 s/n03-02030, W4GF, 7216 Valleycrest Blvd., Annandale VA 22003 (703) 560-5229.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Regency, Genave, Drake, Standard, Clegg, Ten-Tec, Kenwood, Tempo, Midland, Galaxy, Hy-Gain, CushCraft, Mosley, Ham-M, Hustler, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal, friendly Hoosier service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812)-894-2397.

WARREN HAMFEST, Largest family style Hamfest in East. Sunday, August 19th, @ Famous Yankee Lake Park. Giant Fleamarket, Swimming, Picnicking – All Free. Details QSL W8VTD.

TUBES, RECEIVING AND TRANSMITTING. Many oldies. What do you want and what will you pay. B. Weed, 283 Davis St., Northboro, Mass. 01532.

HAMFESTERS 39th Hamfest and Picnic, Sunday, August 12, 1973, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, southwest of Chicago. Exhibits for OM's and XYL's, Famous Swappers Row. Information contact John Raiger K9DRS, 8919 Golfview, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 So. California Ave., Chicago, Ill. 60629.

2M FM TRANSCEIVER – Denshi (identical with Ross-White – see 73's review, April 1972, p.99). 13 measured watts output. 12 channels, Sentry precision, .0005 crystals, 146.04/64; 13/73; 16/76; 19/79; 22/82; 25/85; 28/88; 31/91; 34/94; 94/94; 52/52. Accessories, manual, extras, original carton. Phelps-Dodge 5/8 wave 3.5 db gain antenna, trunk – roof mount. Two months old – too much traveling non-repeater-served areas. $355 complete. Delivered continental U.S. WA1GNX, Bob Reinhart, 11 Old Field Road, Rowayton, Conn. 06853.

"DON AND BOB" new guaranteed buys. Triex MW50 Tower 250.75; MW65 331.50; W51 (FOB Calif.) 386.00; HAM-M 99.00; TR44 59.95; AR22R 31.95; HyGain TH6DXX 139.00; 204BA 129.00; TH3MK3 114.00; Mosley CL35 149.00; CL33 124.00; TA33 114.00; MCQ3B 91.00; S402 143.00; MP33 90.00; Belden 8214 RG8/U foam coax 17¢/ft; 8448 8wire rotor cable 10¢/ft; Mallory 2.5A/1000PIV epoxy diode 29¢; Write specific needs new panel meters, many stock; quote discontinued tubes; Quote Clegg FM27B; Hallicrafters FPM300A; Standard; Regency; Eimac; Midland 2MFM; Collins and CDE replacement parts stock; Hardbound technical magazines, many types from Petro Library 3.00/yr, write needs. 9pin ceramic 6LQ6 socket 50¢; 6V/12V/24V/1.5A transformer 2.49; 135V/500MA-6.3V/3A 2.95; All items guaranteed, shipping charges collect. Madison Electronics, 1508 McKinney, Houston, Texas 77002 (713) 224-2668.

CANADIANS, FREE 120 page electronics catalog, ETCO-B 464 McGill, Montreal.

GIANT N.E. CONVENTION sponsored by FEMARA Sept. 29& 30 at Dunfey's Hyannis Resort on Cape Cod. Huge flea market, seminars, FM, SSTV, NEDXCC, AMSAT, YL trips, 2 pools, golf, beaches, sailing. Early bird registration still only $3 from W1ZQQ, 17 Barnes Ave., E. Boston, Mass. 02128. Special early bird hotel discount available.

PLASTIC ENGRAVED CALL PLATES w/pin $1.25. WA2UUY, 15 Vincent St., Parlin NJ 08859.

HOMEBREW 1KW LINEAR W/PS $85. ATV camera #XT1A $65. Homebrew ATV 15W xmtr $30. Christie, 92-25 175th St., Jamaica NY 11433.

GONSET Communicator III 2 meters $100, Gonset 3063 2 meter power amplifier $75, package $150; Motorola P-33BAC with Ni-Cads 94/94 34/94 $125; Heath HX-20 $110, HR-20 $75, HP-20 $25, HP-10 $35, Hustler 80-10 mobile antennas mast mount $35, package $145; you pay shipping – W5PNY, 2506-A 35th St., Los Alamos, New Mexico 87544.

WANTED OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

ROANOKE DIVISION CONVENTION – Sept. 14–16, 1973, Reston, Va. (near Dulles Airport) Unusual wide interest programs and sessions. Write K4MD, Box 7388, Warrenton, Va. 22186.

BAHAMAS, Great Exuma Hillside lot three way take-off, 80 feet by 125 feet, $3,000 or nearest. Photos available. Talbott, 940 Dellwood, Victoria, British Columbia.

FINDLAY ANNUAL HAMFEST, Riverside Park, Findlay, Ohio – Sunday, Sept. 9 – Advance Donation Tickets $1.00 from C. Foltz W8UN, W. Hobart, Findlay, Ohio 45840.

HP416A ratiometer $125. Gertsch RT-5R ratiotransformer like new $100, Beckmen 7250 BR counter $35. Frequency standard – late model NAVY – URQ-9. 5, 1, .001 MHz output, 220 VAC or 24 VDC emergency input. Similar in specs to a Sultzer 5 with 5P supply $1000. Will consider trade for surplus video equipment.. Norman Gillaspie, Box 2124, Monterey, CA. 93940. 1-408-375-7424.

WANTED!! Engineer/Technician ready to meet the challenege of exciting new products. We want a sharp man with experience and ideas to join the technical staff of ISC/Clegg. Great opportunity for the right man. contact Ed Clegg at ISC, Clegg Division, 3050 Hempland Road, Lancaster, PA 17601. (717-299-3671)

MIX PLEASURE WITH PLEASURE. 1973 Hamburg International Hamfest on Sept. 15 only 45 minutes from fabulous Niagara Falls. RV parking for weekend only. $2.50 with hook-up. Details: Valerie Orgera K3KQC, 187 Main, Hamburg, N.Y. 14075.

DRAKE 2C Xtal Calb. with 2C Q and Drake 2NT xmtr. $295.00. Like new. Bart Burne, 1725 Wyoming Ave., Scranton PA 18509.

FOR SALE! Hammarlund FM50A. 35 watt FM transceiver with remote and manual, very good condition, $135. With xtals for C.A.P. $160. Shipping paid. Patrick Butler, 1833 N. Indiana, Peoria, Ill. 61603.

WANT HP-35 CALCULATOR, certain toy trains; cash or trade FT-101, ML-2. Describe trains by lettering/numbers, not by age. K9CMN, 3381 Howell, Milwaukee, Wis. 53207.

COMPLETE STATION $525 firm or separate as listed, HT 37 $185, SX101A $155, HA 2 with PS $125, Home Brew Linear (matches HT 37 1000 Watts) $100, D104 $15, Johnson Matchbox two element 2 mtr collinears with stacking kit $25; will not sell separate before chance to sell complete. Also have back issues of QST from 1925 up – most complete – send SASE for list – would prefer to sell complete. Write K1VNE, Tom, 22 Lockwood St., Bellows Falls, Vt. or call days 802-254-9988, 802-463-4209.

WILL PAY $4.00 each for magnetic tapes for IBM MT/ST Selectric Composer. Must be in top condition. Box UN11M, 73 Magazine, Peterborough NH 03458.

Charles J. Vlahos WB2ICV
15 Indian Drive
Woodvliff Lake NJ 07675

SPINOFFS: FROM NASA TO THE RADIO AMATEUR

Probably better than anyone else, the radio amateur fully recognizes that one of the great sophistications of our space program has been radio communications. The many successes of our manned and unmanned capsules and satellites are old hat by now, but consistent success obviously would not have been possible without significant advances in telemetry, communications, and more specifically, electronics. Probably no industry in the world, at any time, has advanced the state of the art of electronics as has NASA, through its vast network of contractors and subcontractors.

Fortunately for general industry – and for the radio amateur – NASA and the Atomic Energy Commission have established a program to disseminate much of this information to the general public. NASA calls this program the "Technology Utilization Program." Its purpose is just what it says, to pass on to the public those developments which could have potential use outside the aerospace and nuclear communities. The object of all this is to allow NASA and the AEC to earn for the public an increased return on the public's investment in aerospace and nuclear research and development programs. The whole concept is often referred to as the "spinoffs" from space.

In the course of my work, I have been privileged to review many of the publications published for this purpose by NASA. While many of the offerings are highly specialized and mostly applicable to industry, we did note a few that are worth passing on to the radio fraternity.

What follows are selected extracts that appeared in recent NASA bulletins, more specifically, SP-5942(01) and SP-5943(01). The first bulletin is entitled, "DC Power Circuits" and the second, "Testing Methods and Techniques: Testing Electrical and Electronic Devices." Both bulletins are available through the National Technical Information Service, Springfield VA 22151, at $1.00 a copy. Each bulletin also includes a reader's service card for additional information.

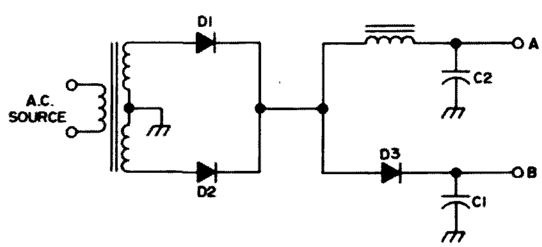

Fig. 1. Dual-voltage power supply with increased efficiency.

You will note in each case values of electronic components are omitted. This was not an oversight, as the bulletins do not as a rule show the value of the specific component to use. It's quite possible that sending in the reader's service card mentioned above will bring the reader this additional information. On the other hand, the more knowledgeable and enterprising amateur can substitute his own values and still get the

desired results. The code following each project is a NASA code for reference purposes.

Dual-Voltage Power Supply

This circuit can be used in lieu of relatively complex and expensive voltage regulators to supply dual voltages wherever precise voltage regulation is not required.

Figure 1 shows the primary winding of the power transformer is connected to the ac source, and the secondary winding is connected to the full-wave rectifier consisting of diodes D1 and D2. The unfiltered output from the full wave rectifier is fed, in parallel, to a conventional choke-input filter branch and a diode-capacitor branch. The diode, D3, in this branch conducts on the peaks of the full-wave rectifier current and charges capacitor C1 to the peak voltage across one-half of the secondary winding of the power transformer. The voltage at terminal A is approximately 40% greater than at terminal B. The required peak inverse-voltage rating of diode D3 is only one-half the peak voltage across the full secondary winding. For maximum voltage output at terminal A, a high conductance semiconductor diode is used in the branch. Source: Lewis Research Center (LEW-90107).

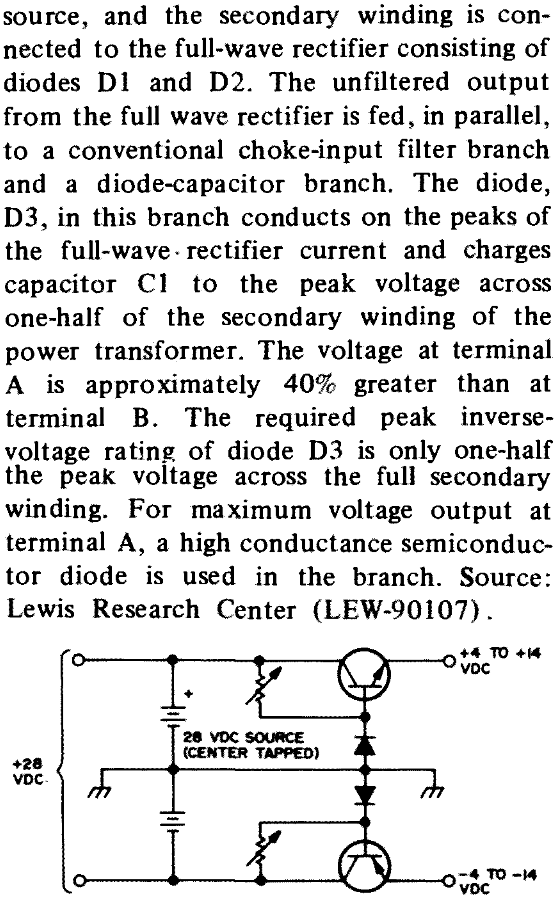

Fig. 2. Dual polarity power supply.

Dual Polarity Power Supply

A majority of electronic systems use individual oscillator-transformer-rectifier power supplies, operating from 28V dc to supply a positive and negative voltage for the subassembly units. In Fig. 2, the dual polarity power supply provides a +14 and -14V to operate the various subassembly electronic modules directly, instead of using a 28V dc supply with the negative terminal grounded. Other 28V accessories; i.e., motors, relays,

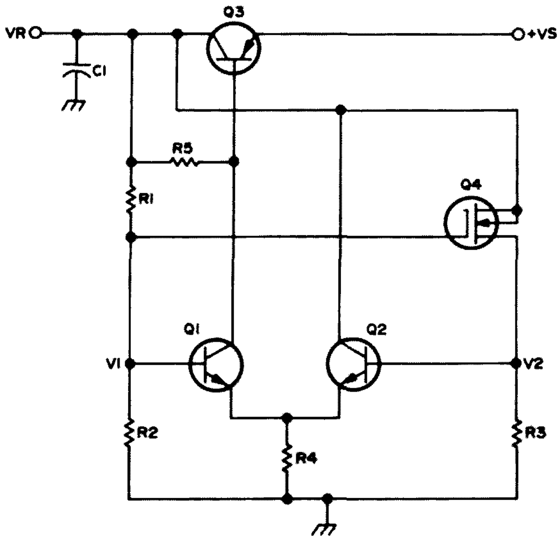

Fig. 3. MOSFET improves power supply regulator.

and solenoid valves can be operated on a 28V input, with the return to -14V. Using separate supplies provides a measure of redundancy and minimizes electronic interference from closing relays and switches.

The circuit performs the function of a power distribution network for the other modules, without the need of a transformer. Important advantages of the unit include significant reductions in weight, size and costs, and internal power dissipation.

Source: G.O. Bohot, P.E. Fincik, and A.L. Varneau of No. Am. Rockwell Corp. under contract to Manned Spacecraft Center (MSC-17072)

MOSFET Improves Performance of Power Supply Regulator

The circuit shown in Fig. 3 provides a higher degree of power supply voltage regulation and temperature compensation than a conventional circuit using a zener diode as a voltage reference. The improvement is made possible by using a MOSFET, Q4, as the voltage reference in place of the zener diode. As in the case of the conventional regulator, the improved regulator utilizes a bridge circuit R1, R2, Q4 (in place of a zener diode) and R3, and a difference amplifier consisting of Q1, Q2, and R4, and R5 allowing initial operation at power turn-on. The regulator performance is determined by the voltage difference between V1 and V2 produced by a change in regulator supply VR. The difference amplifier gain and current gain of transistor Q3 amplify this voltage difference to determine the closed loop performance. Cross coupling of the gate of Q4 to the base of Q1 allows Q4 to serve also as an additional amplifier.

Source: D.C. Lokerson, Goddard Space Flight Center (GSC-10022)

Testing Semiconductors Without Disconnecting Them From Circuit

An oscilloscope, together with the test circuit shown in Fig. 4, can be used to check semiconductors that are wired into a circuit. For transistors, approximate gain and linearity can be determined; for diodes, open

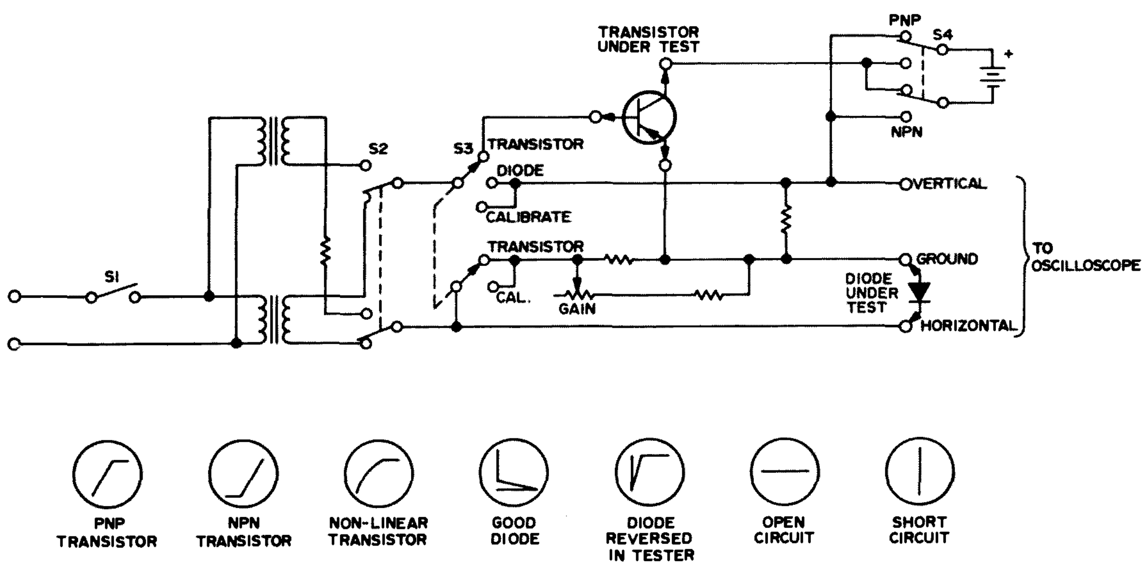

Fig. 4. Circuit for testing semiconductors "in circuit."

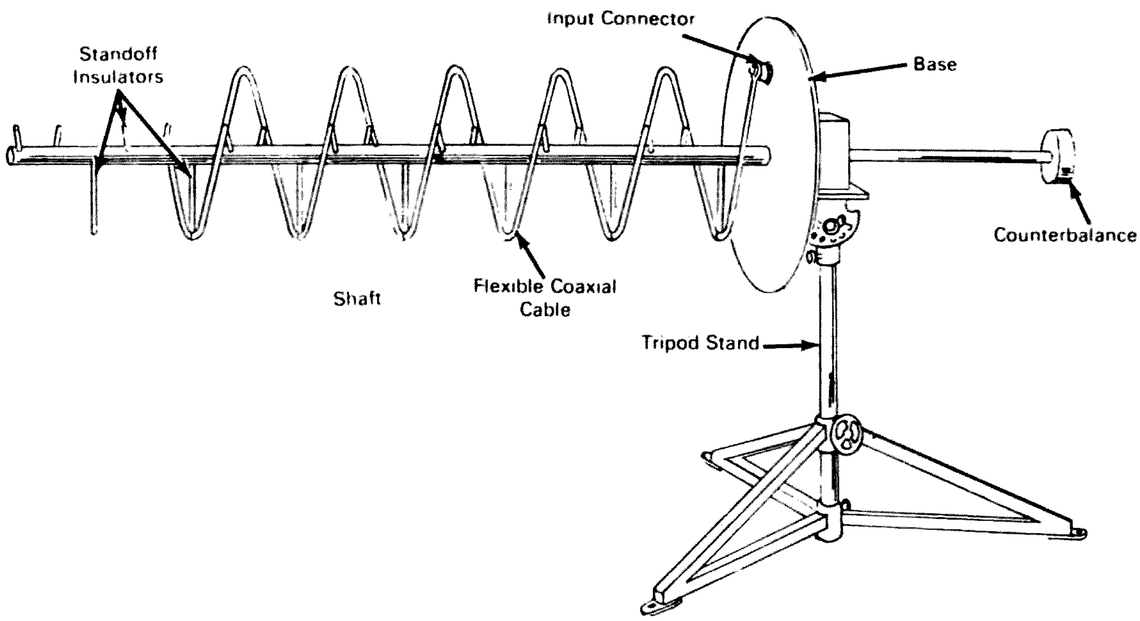

Fig. 5. Economical weatherproof helical antenna.

circuits, short circuits, and reversed polarity are indicated clearly. The quality and breakdown point of low voltage (less than 10V) zener diodes can be measured.

The idealized oscilloscope traces show the types of waveforms to be expected under various circumstances, provided that the impedance of the external circuit is much greater than that of the component under test. If this is not so, the waveforms will vary, depending on the external circuit properties. In either case, when an assembly to be tested contains multiple identical circuits, the tester may be employed to identify a defective component.

Source: B.C. Allen of No. Am. Rockwell Corp. under contract to Marshall Space Flight Center (MFS-1163)

Besides the reports mentioned above, NASA also published periodic "Tech Briefs," short data sheets which describe specific solutions to specific problems. One such Tech Brief – #70-10016 – describes a simple and economical helical antenna that has application to amateur radio:

The Problem: To provide an inexpensive, weatherproof, helical antenna which requires minimum maintenance and which can be easily transported and assembled.

The Solution: Previously, helical antenna elements have been formed from soft copper tubing, shaped with a customed-machined mandrel. Antennas made by this method are very expensive, and furthermore, are susceptible to corrosion. Both of these problems have been solved by using a semi-rigid coaxial cable to form the helical element.

How It's Done: The helix of the weatherproof antenna illustrated in Fig. 5 is made of foam dielectric, heliax transmission line that has been shorted out at each end. The helix is formed by mounting the transmission line on standoff insulators, which are attached to the antenna shaft. By this technique, the helix can be formed with any diameter, pitch, or taper without requiring expensive tools or techniques. Because the p conductors are sealed in plastic, the resulting antenna element is highly corrosion resistant and may be used at seacoast facilities or on range tracking ships with minimum maintenance.

Note: No additional documentation is available. Specific questions, however, may be directed to: Technology Utilization Officer, Kennedy Space Center, Florida 32899, Reference: B70-10016. This invention is owned by NASA and a patent application has been filed.

...WB2ICV

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GRID DIP TUNING THE QUAD

This article describes an effective procedure of tuning the radiators and parasitic elements of a quad antenna with the aid of a grid-dip meter. It is important to tune not just the radiators but also the reflector and director elements for optimum results.

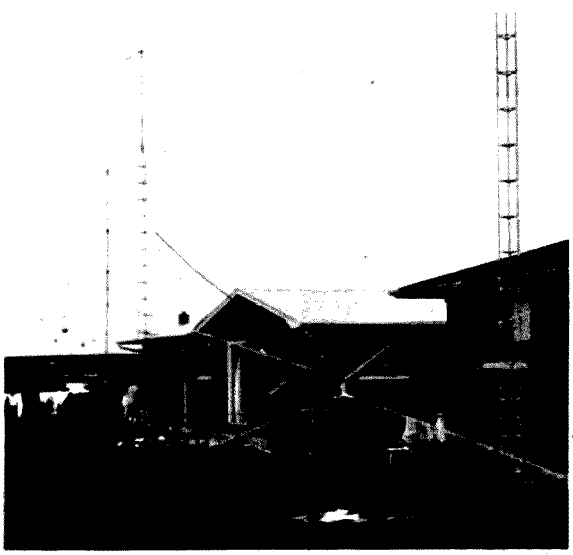
Some time ago, I ordered my 3 band, 2 element spider type fiberglass quad. I assembled it according to instructions, fit the toroid balun to permit a single feedline and put it on top of my tower.

Then I asked a friend to supply me with a steady carrier signal on the 3 bands to adjust the reflector stubs for optimum front/back ratio.

On 15 and 10 meters I couldn't reach a maximum since there was not enough to shorten out, and on 20 meters I had to add a few cm of stubwire to reach a maximum. My front/back ratio was less than 2 S-units for the 15 and 10 meter band and between 3 and 4 S-units for 20 meters.

After this tedious tower climbing exercise I checked my SWR on all bands. It was 3:1 on the average. The feedline was shortened foot by foot and eventually I reached a glorious SWR of 2:1 on 20 and 15, and 2.8:1 on 10 meters.

Well, I wasn't pleased with it and there was a long way to go for the manufacturer's spec of 1.14:1 on all bands. I borrowed an antenna bridge (antenna-scope) to measure the antenna impedances at the various bands. The results were inconclusive; maybe the bridge didn't work well or the radiators were too far off resonance. After that I



The author contemplates the problem of getting his new quad to the top of his tower.

decided to use a grid-dipper to check the resonance frequencies of all radiator and reflector elements.

Radiator Resonance Measurement

I connected a 5 turn "pick-up" coil to the end of the coax feedline down in my shack and dipped the resonance frequencies of the 3 bands carefully. The dips were weak but readable. Before measuring each band I calibrated the grid-dipper on my receiver. Only the 20 meter radiator resonated within the amateur band, while the 15 and 10 meter radiators were 500 and 900 kHz below the band edges.

To measure the reflectors I climbed up the tower and tried to dip the reflectors by coupling the grid-dipper to the reflector loops. Unfortunately I couldn't get a dip at all. Upon this I took my quad down and stuck it on a 3 meter pipe in my back yard. Down there I measured the radiator resonances to know the ground effects on the resonance frequencies. The resonance frequencies were about 100 kHz lower than up in the air.

All radiator wires were readjusted to give resonance readings at 14.05, 21.05 and 28.5 MHz (this measurement was done with the feed line connected). Up in the air this should give me my desired centerband frequencies of 14.15, 21.15 and 28.6 MHz.

Reflector Resonance Measurement

My next problem was to measure and optimize my reflector elements. To do this I replaced all tuning stubs with 10 turn, 1 cm diameter wide spaced silverware coils. These coils were supported on the original nylon stub spacers. See Fig. 1. The reflectors could now be dipped easily by coupling the grid-dipper to the end of the stub-coils.

While my 20 meter reflector resonated 350 kHz below the according radiator element, the 15 and 10 meter reflectors resonated too low by 900 kHz and 1.8 MHz respectively. Since the 20 meter band per-

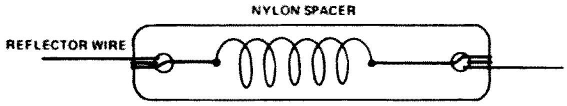


Fig. 1.

formed best before I readjusted the other reflector loops to give resonance frequencies of 400 kHz (15 meters) and 500 kHz (10 meters) below the related radiator resonance frequencies.

I checked and rechecked all resonance frequencies and raised the antenna gain. Then I redipped all elements "up there." This is easy with a 2 element quad since each element can be reached from the tower. Only the 15 meter reflector required some adjustment. I shortened 5 of the 10 turns of the "stub coil" to increase the resonance frequency by 150 kHz.

Results

Now I measured the SWR again. It had decreased to: 1.25:1 (20); 1.15:1 (15); 1.3:1 (10); centerband readings, and, at the lower band edges: 1.5:1 (20); 1.4:1 (15); 1.6:1 (10). The front/back signal ratio improved also: I measured 3–4 S-units on 20 meters, 4 S-units on 15 and 10 meters. At the side of the antenna I measured signal rejections as high as 10 S-units (60 dB).

The tuning procedure for a quad antenna with a grid-dipper is very effective and gives superior results. All antenna elements are tuned individually; this definitely beats my trial and error technique. Three and four element quads can be tuned the same way. As a matter of fact, grid-dipping is the only way to tune the director elements, since neither the F/B ratio nor the directivity pattern can be measured sufficiently accurately to permit precise conclusions.

The resulting performance and low SWR are certainly worth the effort.

The table below gives suggested resonance frequencies for the various bands and elements of a quad. Two sets of values are given. The values in parentheses give your quad a wider bandwidth and slightly lower SWR over the entire band. In return the front/back signal ratio and antenna directivity decrease somewhat.

	Center frequency		
Reflector	13.85(13.6)	20.8(20.5)	28.1(27.7)
Radiator	14.2(14.2)	21.2(21.2)	28.6(28.6)
Director 1	14.6(14.9)	21.7(22.0)	29.2(29.6)
Director 2	15.1(15.7)	22.3(22.9)	29.9(30.7)

...VE3GSP

FCC RULES AND REGULATIONS, FART 97 (II)

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

CONTENTS THIS MONTH

97.29 Manner of conducting examinations.
97.31 Grading of examinations.
97.33 Eligibility for re-examination.
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STATION LICENSES

97.37 General eligibility for station license.
97.39 Eligibility of corporations or organizations to hold station license.

§ 97.29 Manner of conducting examinations.

(a) Except as provided by § 97.28, the examination for Amateur Extra, Advanced and General Classes of amateur operator licenses will be conducted by an authorized Commission employee or representative at locations and at times specified by the Commission.

(b) Unless otherwise prescribed by the Commission, an examination for the Conditional, Technician, or Novice Class license will be conducted and supervised by a volunteer examiner selected by the applicant. A volunteer examiner shall be at least 21 years of age and shall be the holder of an Extra, Advanced, or General Class Amateur Radio operator license, or shall hold a Commercial radiotelegraph operator license issued by the Commission, or shall be employed in the service of the United States as the operator of a manually operated radiotelegraph station. The written portion of the examination shall be obtained, supervised, and submitted in accordance with the following procedure:

(1) Within 10 days after passing the required code test, an applicant shall submit an application (FCC Form 610), together with any filing fee prescribed, to the Commission's office at Gettysburg, Pennsylvania, 17325. The application shall include a written request from the volunteer examiner for the appropriate examination papers. The examiner's written request shall include (i) the names and permanent addresses of the examiner and the applicant, (ii) a description of the examiner's qualifications to administer the examination, (iii) the examiner's statement that the applicant has passed the code test for the class of license involved under his supervision within the 10 days prior to submission of the request, and (iv) the examiner's written signature. Examination papers will be forwarded only to the volunteer examiner.

NOTE: When the applicant is entitled to examination credit for the code test under one of the provisions of § 97.25, an application may be submitted without regard to the 10-day limitation. The examiner's request should then state that a code test was not administered for that reason. The applicant should furnish details as to the class, number, and expiration date of any Commercial radiotelegraph license involved.

(2) The volunteer examiner shall be responsible for the proper conduct and necessary supervision of the examination. Administration of the examination shall be in accordance with the instructions included with the examination papers and as prescribed in §§ 97.29 (c) and (d), 97.31, and 97.33.

(3) The examination papers, either completed or unopened in the event the examination is not taken, shall be returned by the volunteer examiner to the Commission's office at Gettysburg, Pa., no later than 30 days after the date the papers are mailed by the Commission (the date of mailing is normally stamped by the Commission on the outside of the examination envelope).

(c) The code test required of an applicant for amateur radio operator license, in accordance with the provisions of §§ 97.21 and 97.23 shall determine the applicant's ability to transmit by hand key (straight key or, if supplied by the applicant, any other type of hand operated key such as a semi-automatic or electronic key) and to receive by ear, in plain language, messages in the International Morse Code at not less than the prescribed speed, free from omission or other error for a continuous period of at least 1 minute during a test period of 5 minutes counting five characters to the word, each numeral or punctuation mark counting as two characters.

(d) All written portions of the examinations for amateur operator privileges shall be completed by the applicant in legible handwriting or hand printing, and diagrams shall be drawn by hand, by means of either pen and ink or pencil. Whenever the applicant's signature is required, his normal signature shall be used. Applicants unable to comply with these requirements, because of physical disability, may dictate their answers to the examination questions and the receiving code test and if unable to draw required diagrams, may dictate a detailed description essentially equivalent. If the examination or any part thereof is dictated, the examiner shall certify the nature of the applicant's disability and the name and address of the person(s) taking and transcribing the applicant's dictation.

§ 97.31 Grading of examinations.

(a) Code tests for sending and receiving are graded separately. Failure to pass the required code test for either sending or receiving will terminate the examination.

(b) Seventy-four percent (74%) is the passing grade for written examinations. For the purpose of grading, each element required in qualifying for a particular license will be considered as a separate examination. All written examinations will be graded only by Commission personnel.

§ 97.33 Eligibility for re-examination.

An applicant who fails examination for an amateur operator license may not take another examination for the same or a higher class amateur operator license within 30 days, except that this limitation shall not apply to an examination for an Advanced or General Class license following an examination conducted by a volunteer examiner for a Novice, Technician, or Conditional Class license.

§ 97.35 Additional examination for holders of operator licenses obtained by mail.

(a) A licensee who holds an amateur license which was obtained by a mail examination under the supervision of a volunteer examiner may be required to appear for a Commission supervised license examination at a location designated by the Commission. If the licensee fails to appear for this examination when directed to do so, or fails to pass such examination, the operator license involved shall be subject to cancellation. When a Novice, Technician, or Conditional Class license is cancelled under this provision, a new license will not be issued for the same class operator license as that cancelled.

(b) [Reserved]

(c) A holder of a Conditional Class license, obtained on the basis of an examination under the provisions of § 97.29(b), is not required to be re-examined when changing residence and station location to within a regular examination area, nor when a new examination location is established within 175 miles airline distance from such licensee's residence and station location.

STATION LICENSES

§ 97.37 General eligibility for station license.

An amateur radio station license will be issued only to a licensed amateur radio operator, except that a military recreation station license may also be issued to an individual not licensed as an amateur radio operator (other than an alien or a representative of an alien or of a foreign government), who is in charge of a proposed military recreation station not operated by the U.S. Government but which is to be located in approved public quarters.

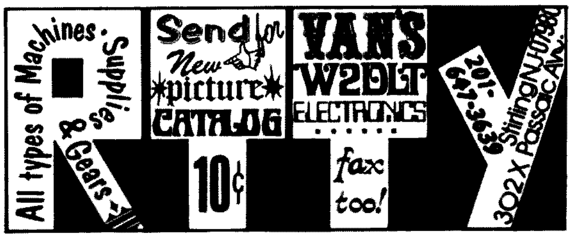
[§ *97.37 revised eff. 10-17-72; VI (72)-1*]

§ 97.39 Eligibility of corporations or organizations to hold station license.

An amateur station license will not be issued to a school, company, corporation, association, or other organization, except that in the case of a bona fide amateur radio organization or society, a station license may be issued to a licensed amateur operator, other than the holder of a Novice Class license, as trustee for such society.

[§ *97.39 amended eff. 12-1-72; VI (72)-1*]

(To be continued next month)



I can understand why there may be some irritation over this at HQ. The League is supposed to provide leadership and to know the answers – and I hope I won't be accused of any exaggeration when I suggest that ARRL could have done a lot better in this. I understand that all repeater applications using the QST article on determining height above average terrain are being rejected by the FCC. I understand that the phone companies are very upset over the QST article on telephone remote control. That's two articles, and both bombs. But why take out your frustration on me? You need someone on the staff with repeater experience. Isn't it time to look around and get a staffer who can help QST get up to date on the largest single facet of our hobby today?

If there could be more positive thinking – trying to help rather than trying to bad mouth me and shoot me down – I think everyone would benefit. The reason that repeater groups turn to me is because ARRL has dropped the ball. If they could get answers from HQ they would.

Harry, as you know, I have offered verbally and in writing to work with the League in any way possible toward their goal of getting Mr. Walker transferred so the growing flood of restrictive and asinine (to use Lew McCoy's word) regulations will stop. I think it is important for all of us to work together in this if amateur radio is to ever get back on its feet – and I think you agree. Let's cut out the hatchet jobs and work together – *please.*

BRAINS TURN TO JELLY

An article in a recent issue of *Psychology Today* backed up something that I've always suspected; noise gradually turns your brains to jelly. This backs up my suspicision that the FCC is behind a plot to destroy amateur radio – it all fits in. Their recent ruling seems just to be insane – it made no sense at all – no one could figure out why the FCC had suddenly demanded continuous monitoring of repeaters. Now it begins to be clearer – this is part of the plot to turn the brains of repeater control ops to jelly and thus insure their early demise.

Look what rock music has done to the kids!

FCC EXAMINATIONS

Let's take a look at a recent monthly report on license exams given and see what sort of statistics are reaching the amateur division chief.

Okay, let's just look at those figures for a minute. Note that high percentage of General failures. The report goes on to show that about 60% of those taking the written General exam fail it. I'll bet they never read our study guide book!

The 37% overall failure is interesting. That means that over one third of those taking an exam fail it. If you think of that in terms of what it costs on the average for amateurs to get their license – at $9 per try – this comes to $14.31 each. When the price goes up soon to $10 that will assay out at $15.90 average.

Note that 18% failure rate for supervised Tech license exams. The report form shows that 435 mail exams were given for Tech and that 69 failed this – a failure rate of 16%.

	Total	Tech	General	Advanced	Extra
Supervised					
Exams	2691	337	1582	511	261
Passed	1692	277	838	371	206
Failed	999	60	744	140	55
% Failed	37%	18%	47%	27%	21%

Licenses by Classes

	Novice	Tech	Condit.	General	Advanced	Extra	Total	
3-66	14862	58825	39780	105149	38781	4523	261,920	
3-67	11866	58561	37597	106957	37379	4796	257,156	-4764
3-68	12778	57002	35988	108089	37804	5881	257,545	+ 389
3-69	15910	54675	33992	100064	45862	8405	258,908	+1363
3-70	22694	53666	32730	95394	50736	10014	265,234	+6226
3-71	23305	52876	31706	91980	54692	10998	265,559	+ 325
3-72	24118	52224	30726	89182	57283	11716	265,249	- 310
3-73	24052	51060	29198	85971	59288	12239	261,808	-3441

This would seem to put the lie to the theory propounded by Walker that a high percentage of the mail exams are passed fraudulently. Those percentages are almost exactly the same!

The amateur going for the Tech or the Extra has a pretty good chance of making it. The most difficult one is the General with the 47% failure. When you work out the cost of getting that license it comes to an average of $16.98 at the $9 fee and $18.87 when the price goes up to $10 per try. The fact is that it is going to cost about half of those trying $20, at least. Mounts up, doesn't it?

KC REPEATER SHUT DOWN

On my recent trip through the midwest I got the report that the main Kansas City machine had been shut down because the local FCC official was part of a small competing repeater group and forced the big one to shut down. It seems that some changes had been made since the October 17th deadline and thus the repeater was not exactly the same as before – and thus could not be grandfathered along until June 30th. The FCC strikes again! Why, oh why don't they devote even a small part of this persecution to the CB mess?

FCC RESPONSIBILITY

Since the FCC has taken over control of new ham rules and regulations – as witnessed by the punishment licensing deal in the 60's and the repeater licensing recently, it follows that the responsibility for the growth of the service is theirs too. Obviously it is the rules which govern, in the last analysis, the growth or death of the service.

Even a casual look at the graph of the number of amateurs over the last twenty years tells the story. Punishment licensing was proposed by the ARRL in 1963 – the FCC futzed around for four years – and look at the curve! Growth stopped short in 1963. Now do you really think that was a coincidence?

The Commission has done absolutely nothing whatever, after ten years of total stagnation, to get amateur radio into gear again. They have turned a deaf ear to amateur proposals for encouraging growth – and they have come up with nothing on their own. It is way past time for the Commission to face its responsibility and do something – or else change their basic policy and stop preventing amateurs from having a say in the thing.

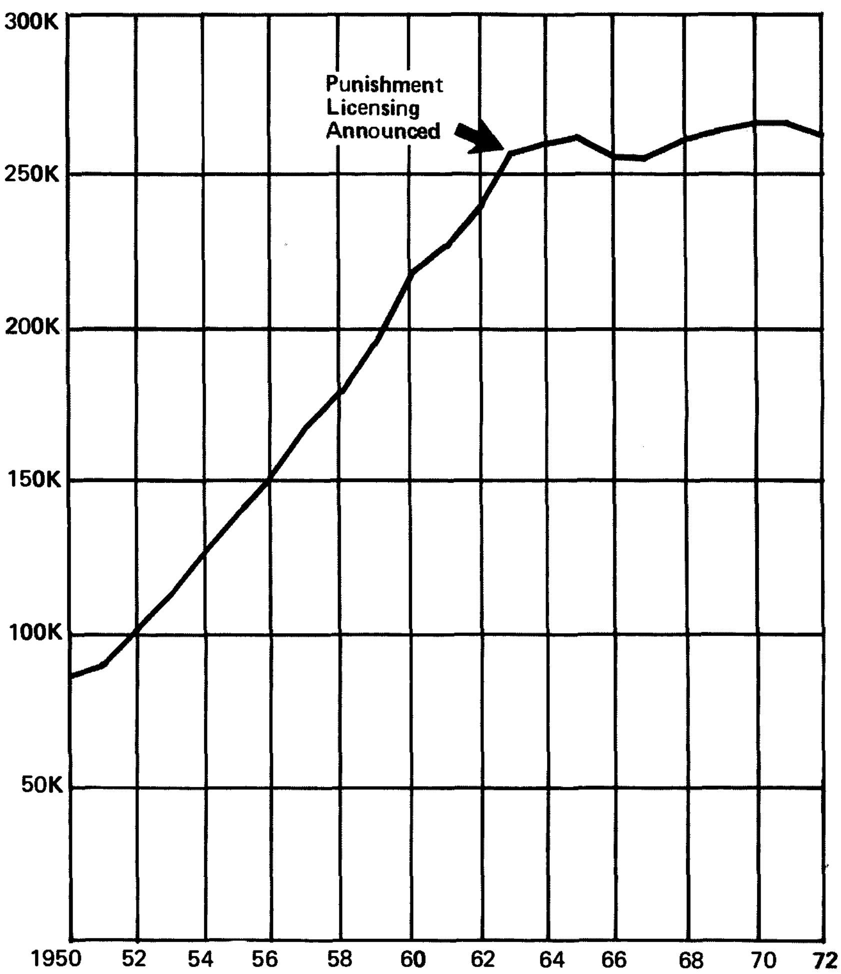
It is time that amateurs started making it known to the FCC that they are fed up with the situation – that new rules are needed which will encourage growth.

NEW CHANNEL 1 TELEVISION?

The broadcast magazines and newspapers have been reporting new FCC interest in channel 1 television – for educational stations. Ch 1 was originally 50–56 MHz back in 1941 and then changed to 44–50 MHz in 1945. No TV stations ever used the channel and it was reassigned to the land mobile services.

If they decide to reassign Ch 1 for ETV then they would have to move the land mobile users to higher frequencies. It is possible that they might decide that hams in between Ch 1 and Ch 2 would cause too much TVI and either kill the 6m band, make it smaller, or move it a bit.

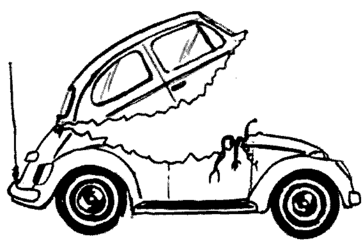
We are not in a strong position on this because we have far too few amateurs to keep this band active. It is unfortunate that attempts to open a new hobby class of amateur license have been so bitterly opposed by the League as this might have provided the new amateurs which could have occupied the 6m band. We do need a



lot of new amateurs and it would seem of first importance to figure out how we are going to get them. We don't need 10% more, we need 500% more.

RIPPED OFF RIGS

Several of the Dayton Hamventioneers who were staying at the Howard Johnson motel had their cars broken into and their rigs ripped out. In one case the burglars were not able to easily remove the rig so they chopped out the dashboard, rig and all, leaving a shambles. Maybe we should leave the rigs on the seat, ready to go?



Mr. Johnson shrugged his shoulders, when asked about his liability as hotel keeper. Those amateurs who had made peace with their insurance agents will probably be reimbursed to some extent. Obviously you have a lot to gain and nothing to lose if you get together with your agent before the rip off and make sure that you are actually insured – and that you will get enough to buy a new rig when yours is stolen. Find out about the equivocation before the fact instead of fuming at the agent afterward.

It doesn't hurt one bit to make a note somewhere of the serial numbers of the gear involved – and what can it cost you to write your name and address inside the case with a vibrator tool? As soon as you discover the tragedy notify the local fuzz and get that event into the record. You could do worse than send the serial numbers to 73 – a couple of rigs have been found this way so far – and if we work up a truly definitive list it will be used by everyone. As long as some send a note to QST – some to CQ and some to 73, there are too many places to look and it is all a waste of time. And note that 73 is the ONLY magazine that keeps the list going, month after month.

Another idea – the next time you hear a strange voice on the repeater – someone who obviously doesn't know what is what – instead of scaring him, why not get into a conversation with a buddy a little bit later over the repeater and mention that you are really in the market for another rig – have money at hand to pay for it – and give your phone number – you might catch a thief.

Once you have your insurance to protect you, you still have every reason to try to keep from being robbed. It does not do the car any good to have the wind wing bent backwards – the cloth roof slit – a window broken – things like that. And if you have to collect from ye insurance company you can bet that your premiums will soon be prohibitive – not to mention any deductible amounts.

Of course it is basic to make it a practice not to walk off and leave your car unlocked – that's giving your gear away – and perhaps the car too. Make every effort to lock your car even in lots where they want you to leave your keys – some of my worst losses have been in these lots – and they accept no responsibility when they clean out your car for you. Do they pay those boys low wages and let them make it up this way?

If you are going to park your car in high risk areas (like within 100 miles of Manhattan) it might be smart to plan ahead and make a fast removal installation of the rig so you can put it in the trunk when you leave your car – complete with the magnetic mount antenna – you don't need a flag up there saying looky here, bread for the taking. Cigarette lighter plugs work fine and allow the rig to be packed away in less than one minute.

Those power amplifiers can go under the seat out of sight since you don't have to reach it to use it anyway – or you can mount it in the trunk – under the hood – etc.

Car burglar alarms are okay too – particularly if you put in one that will notify you by radio when you have an unwelcome guest in your car. Lacking the money, energy, or interest to install one of these, you can sneak by with some burglars by buying a sticker that says you have an alarm. It can't hurt . . . unless a chap happens along who prefers a challenge in his work and is looking for a decal like that so he can express himself. Mostly it will turn off the run-of-the-mill crook.

MORE ROOM ON 20M?

Somehow I expect that the development of sideband is not quite the end of the line for amateur radio voice communications. True, we don't have anything really in the works right now – nothing with which amateurs are experimenting on the bands in the hopes of developing new techniques, but I will be surprised if a group doesn't come up with something soon.

Back soon after WW II we found a small group of amateurs experimenting with narrow band FM. I remember those early trials, led by Jack Babkes W2GDG in Brooklyn. At first he got special authorization from the FCC to try out the system – then, when it proved workable, the Commission opened segments of the bands for NBFM and Jack was in business with Sonar Radio making narrow band FM gear.

NBFM had some great advantages over AM – no big modulator and modulator power supply, for instance. But it had one enormous disadvantage – unless you had an FM detector on your receiver, AM would overpower the NBFM signal. And for some reason, though the circuit was extremely simple, the popular receivers never included this FM detector – so NBFM gradually died out. Pity.

In the very late 40's and early 50's another group of experimenters started work on sideband – single sideband. This was quickly grabbed up by Art Collins and sideband took over not only amateur radio, but the military too. Another system was being pioneered by G.E. at the same time – and it seemed to have some important benefits over SSB – but Collins had a lot more political savvy than G.E. and the double sideband system, never got a good chance to prove itself.

Before you jump hastily to conclusions about two sidebands taking up more bandwidth than one, you should consider the importance of the synchronous detector – a little gadget which permitted signals with identical signals on both sidebands to come through, but kept out any which were not on both – with the result that you could copy a DSB signal right through a SSB signal – and could copy DSB signals only a few hundred cycles apart. It is possible that we could have a fraction of the QRM on our phone bands if we had gone the DSB route.

There are some techniques which hold promise for allowing less congestion on our phone bands. Some amateurs are beginning to work with digitalized voice systems. I don't know how narrow this would make a signal, but I suspect that it could get down to less than 1 kHz. That would help a lot.

Another possibility might be time diversity. I'm not sure what we would use for a standard clock to keep everyone in sync, but we know that it is possible to break voice up into small segments and send just a part of them and the result will sound normal. We could probably get five to ten stations on each frequency with this type of system.

There are undoubtedly other ways of going about this – any news from readers on this – or the above?

. . . *Wayne*

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July 1973

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1	2	$\boxed{3}$	4	5	6	7
8	9	$\boxed{10}$	$\boxed{11}$	$\boxed{12}$	$\boxed{13}$	$\boxed{14}$
15	16	17	18	19	20	21
22	$\boxed{23}$	24	25	26	27	28
$\boxed{29}$	30	31				

Possible aurora 28, 30.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	7A	7A	14
ARGENTINA	14	14	14	7A	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7A	14	14	14	14	14A
ENGLAND	7A	7A	7	7	7	7A	14	14A	14A	14	14	14
HAWAII	14	14	7A	7	7	7	7	7	7A	14	14	14
INDIA	7A	7	7B	7B	7B	7B	7A	14	14	14	14	14
JAPAN	14	14	7A	7	7	7	7	7	7	7	7	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	7	7	7A	7A
PUERTO RICO	14	7A	7	7	7	7	7	7	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	14	14	14	14	14	7B	7B
U.S.S.R.	7	7	7	7	7	7	7A	14	14	14	14	14
WEST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	7	7A	14	14
ARGENTINA	14	14	14	7A	7	7	7A	14	14	14	14A	14
AUSTRALIA	14	14	14	7	7	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7A	7	7	7	7A	25	25	25	25	25A
ENGLAND	7A	7	7	7	7	7	7	14	14	14	14	14
HAWAII	14	14	14	7A	7	7	7	7	7A	14	14	14
INDIA	14	14	7B	7B	7B	7B	7	7	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7	7	7A	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7A	7A
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	14	14	14	14	7B	7B
U.S.S.R.	7	7	7	7	7	7	7	7	14	14	14	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7	7	7	7A
ARGENTINA	14A	14	14	7A	7	7	7	14	14	14	14	14A
AUSTRALIA	14	14A	21	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7A	14	14	14	14
HAWAII	14	14	14A	14	14	7A	7	7	7A	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	14	14	14	14	14
JAPAN	14	14	14	14	7	7	7	7	7	7	14	14
MEXICO	14	14	7A	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14	14	7B	7B	7	7	7	14	14	14
PUERTO RICO	14	14	7A	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7B	7B	3A	7	7B	7B	7B	14	14	14	7B	7B
U.S.S.R.	7	7	7	7	7	7	7	7	14	14	7B	7B
EAST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 magazine

for radio amateurs

$1.00
August 1973
26009

FCC PROPOSAL THREATENS 220!

Can Sweet Meg Escape the Clutches of CB?

73 magazine
for radio amateurs

#155 AUGUST 1973

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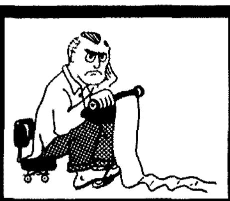
This month the Ancient Mariner fearfully eyes the 220 Albatross on page 37.

The recent Walkergate scandal has just been compounded by the FCB proposal to create a new Class E Citizens Band in the top Megahertz of 220—225. Does the FCB seriously think that a one Megahertz sacrifice will soothe the Citizens Blasphemous? Pictured on the cover is Jane Lake, our 220 girl of the month, being attacked by KDK-2573. Can she be saved?

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A.

Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.



NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

CB ON 224?

You want to know my reaction to the FCC docket? Frankly I think it's a bunch of crap.

The Commission set up the 27 MHz citizens band in the form we have it today and it is obvious to me that they don't give a damn about what is going on there. The FCC has had plenty of opportunity to do something about the mess if they wanted to — but they don't want to. Politics. On the one hand is the heavy arm of the Electronics Industries Association (EIA), the well-funded Washington lobby repesenting CB manufacturers, and on the other is a very vocal group of a million or so people who like what they are doing and see no reason why they should stop — and this means hollering like hell to their congressmen whenever they have a bitch.

So Walker (Prose Walker), the Chief of the CBers, shrugs his shoulders and mumbles about not having the money for enforcement, and the official monitoring stations send out more pinko tickets to hams than they do to CBers. The Commission explains this inequitable system on the basis that, well, hams pay attention to the citations while the CBers just tear them up in anger and ignore them.

Don't you think for one moment that Walker couldn't put the screws to the CB gang the same way he has the hams if he wanted to. He doesn't need a thousand more monitor engineers to do this. The fact is that the FCC has had some very good ideas about what to do to put a stop to the massive violations on 27 MHz, but has flatly refused to carry through with them. Politics.

At one time the FCC was about ready to get started on an organized plan to attack the problems of CB. They were going to get an enforcement group together and move from city to city, issuing massive citations. When spread out all over the country there is little they can do to curb the lawbreakers, but when concentrated in one spot, they could really cool things. The press of the country was behind the idea and looking eagerly to the headlines it would make. It never came off.

The fact is apparent that the FCC is afraid of CB.

So here we are with the Commission about to open up forty more CB channels. They are about to do this even though it means breaking the ITU regulations which limit the 224–225 MHz band to amateur and radiolocation. They are about to do this because they know that they will have less political pressure if they do it.

CB has muscles. The EIA has good connections in Washington, while amateur radio has no lobby and a virtually silent ARRL. Amateurs don't have a low profile in Washington, they have none at all. CBers and CB groups get angry and fight for what they want — hams merely shrug their shoulders and look hopefully at Newington, telling themselves that the League knows what is happening and after all, it's their job to protect us. CBers are most fortunate not to have a League. Without this placebo they realize that they have to fight their own fights and they take the bit in their teeth and raise hell.

No one likes the bearer of sad news. Ghengis Khan used to fill messengers full of sand and return them to their masters when they brought him bad news. The fate of the present day harbinger of gloom dies a slower deather perhaps, but the reaction is enough to keep most magazine editors from leveling with you about how things really are.

The bad news I'm bringing isn't so much the start of an organized gobbling up of a ham band — did you think that CB would stop at 40 channels on 224 MHz when there are 160 more sitting there to take from us? The bad news is that we amateurs have for some reason chosen not to fight for our hobby and for the service it provides.

It doesn't take a whole lot of fight. You don't have to put your life on the line or anything. You just have to say dammit, no! Look what happened to Walker when the repeater groups got their backs up — he backed down. The sad part of that is that Walker was able to grind FMers so far down into the mud before they began to get angry and fight back.

As near as I can figure the antenna pattern requirements for the repeater licenses, Walker had in mind getting some free research data for a project he has been working on for several years. When I came up with the plan for getting standard antennas accepted he fought it as long as he could and then had to give in.

So what has docket 19759, the CB on 224 MHz scheme, got to offer us amateurs? True, it will probably bring us a lot of junky radios we can use in what is left of the band, until they take that away. If the stuff they turn out for this band is as great as the 27 MHz garbage, we're in trouble. How many of you have tried to use a CB rig on ten meters? Well, it won't be that bad, of course, but still a $100 transceiver is going to be marginal in usefulness.

(W2NSD/1 continued on p.18)

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	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

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Gettysburg PA 17325

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Last month I briefly mentioned Robert's (WØLMD) Slow Scan keyboard. Since that time, Robert completed his 230 page college dissertation and was thus able to attend the Birmingham AL convention. So we managed a firsthand look at a direct fast to Slow Scan converter and SSTV keyboard. The keyboard is completely self-contained (excluding power supply) and its pc boards (containing a MOS character generator, IC, some memory ICs, some clocking ICs, etc.) are mounted below the 6x12 in. surplus computer keyboard. A message, ID, or whatever, (up to 5 rows of characters, 6 characters to a row) appears across the screen as it is typed out and persists there indefinitely until the "memory erase" button on the keyboard is pushed. (The clock "reads" out of memory, info which is then applied to the character generator IC driving a VCO at SSTV standards.) There are also keys which allow checking sync, black and white frequencies. The characters may either be read out as black on white, or white on black. The XYL really enjoyed hammering out different messages on the unit. (While remembering to count 6 characters to each line). After that she tried mastering diagonal ID's with horizontal words in the picture corners . . . let's see . . . 2 letters, count 3 spaces, 3 letters, count 1.

What a blast! I remember the first time a message came out "split" on the screen, she declared "That thing made a mistake!". Imagine interfacing a keyboard system like this to your SSTV setup. As each picture is presented, you could type out a description over the picture. Imagine also how handy this could be during contests. Robert's unit cost approximately $100 in parts, and took about a month to build, so I suspect when and if such a unit became available commercially, the cost would be equivalent to a Slow Scan camera. However, this speculation is based on "chip" cost today. Robert may write a full article on the keyboard soon.

The emphasis on moving Slow Scan activity higher in the 20 meter band is becoming quite apparent. We are finding quite a few of our SSTV friends around 14.240 kHz and very little, if any, Slow Scan activity below 14.230 kHz. The basic plan, remember, is to "stack" toward the high end of the band, rather than the low end. The 14.200 kHz to 14.230 kHz region is basically "prime DX" frequencies and Slow Scan activity here generally causes QRM to both DXers and SSTVers. The next time you're looking for a clear frequency, check the .230 to .250 region, and let's get activity jumping here. You can also help tremendously by passing word on this info to other SSTVers.40 meters is doing very well on the SSTV scene also. We've noticed quite a few of the gang around 7171 kHz, the new 40 meter "gathering" spot. This band shows real promise for use during the winter, so let's use it!

An interesting new item displayed by Robot at Dayton this year was their Fast Scan "Viewfinder" (for use with their Slow Scan camera). Although I didn't take time to look inside the unit, the operation appeared very nice. Motion was visible, thus reducing focus time on the camera. A faint line was visible moving in the picture, which indicated the initial trace line of the Slow Scan picture. This seemed quite handy for us in making up smooth "programs."

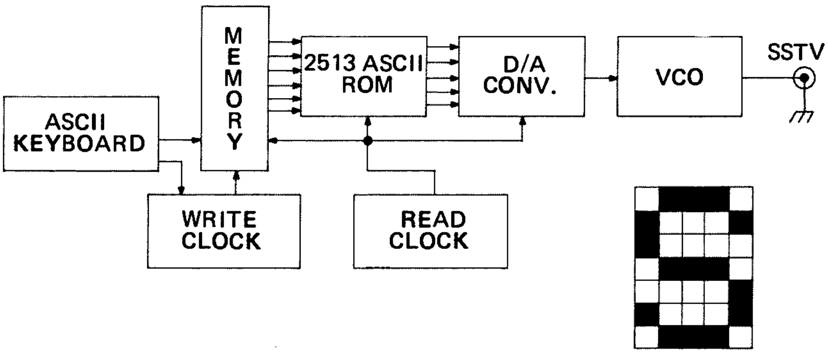


Fig. 1. SSTV keyboard/titler. The computer terminal industry has produced a number of IC's which, when scanned properly, are able to draw alphameric characters on the CRT screen. One such IC, the Signetics 2513 (@ $12) makes a good design center for an SSTV keyboard. Some memory IC's, some clocking IC's and a surplus "computer" keyboard wired for ASCII will make a unit invaluable for contest work, sequence tape titling, CQ'ing, satellite work, etc. The 64 different possible characters are simulated by inputing a 6 bit ASCII code for the desired character, and then scanning through the output 5 x 7 dot matrix at proper times, interfacing this output to the SSTV VCO. The keyboard can also run on fast scan by using a faster read clock approximately 1 MHz in frequency instead of the SSTV read clock of 960 Hz.

Another advantage of the Fast Scan monitor was its brightness. It's difficult to see pictures on the Slow Scan monitor with bright camera lights on, and the "Viewfinder" overcomes this problem. Another surprise from Robot is the modifications to their cameras. The front panel Scan reversal switch now controls a video inverter for nice black to white reversal techniques. Also, a small 3-position switch has been added to the rear panel for selecting 1/4, 1/2, or full frame scanning.

The Robot model 80A and the J&R 500 cameras incorporate slightly different ideas in their partial frame scanning, and this seems an appropriate time to discuss the difference. Using 1/4 frame scanning, both units scan only the top 1/4 of the subject material in front of the camera. The Robot inserts a sync pulse after each of these 1/4 frames (every 2 seconds), the J&R does not. The net result is the Robot 1/4 frame picture is presented on the top 1/4 of a monitor screen, and the J&R 1/4 frame picture is presented 4 times (vertically) on a full screen. Bear in mind that 'MXV monitors' noise immunity circuits are only open to vertical sync pulses every picture "bottom" and thus it will not reset to the "top" every 2 seconds. Both units are superb, however.

I receive quite a few inquiries asking where one can find pc boards for Slow Scan monitors. Here is a brief rundown. W6MXV, Mike Tallant, has either boards or kits available. 2 boards required. About $10 each. Taggart WB8DQT has an article this month in 73 on his new magnetically deflected monitor. He also is planning to sell boards on this monitor. 1 required. About $10 each. Gailek Solid State, 34 W. 13th St., NYC. The full story on this monitor was in June *CQ*, 1973. I do not know their cost.

Finally, I am having some problems with mail, and should you not receive an answer to correspondence with me within a week or so, try sending the mail through *73 Magazine* office. This works very well so far.

I have just received from Franco I1LCF, the following results of the 3rd Worldwide Slow Scan contest. Franco adds since there was such widespread use of SSB by SSTVers, he has not compiled a general score but

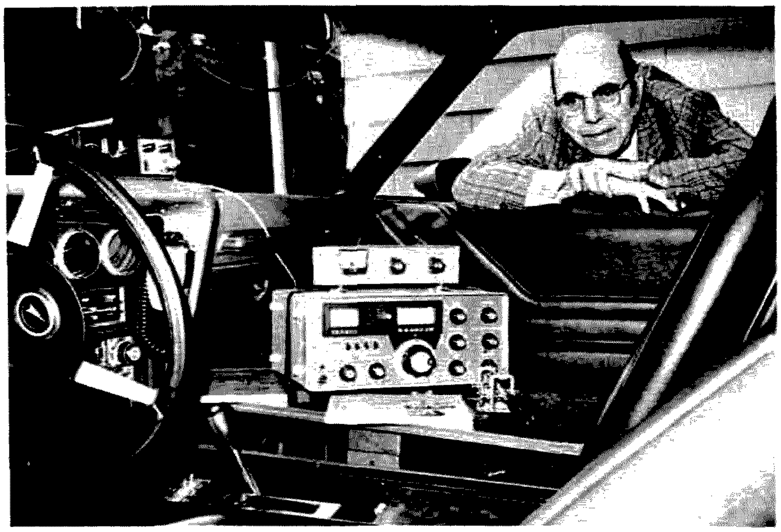
rather a listing of entries received (possibly more info will be available by next month). The entrants are listed below:

CT1PG	I5BNT	SM5CLW
DJØCN	I5CW	PY1DCB
DJ9NG	I1RUB	VE1TV
DL1NI	ISØPEM	VD3GMT
DL2RZ	IT9ZWS	K4TWJ
EA4DT	OD5HC	W6YFT/7
FO8DO	OZ1AT	W7FEN
HA2KRB	OZ2LW	W9NTP
HA5KFA	SM4MI	W5GQV
I5BNT	SM4FT	

S.W.L.

HA5Ø91 ON5UK/ON5EX

...K4TWJ



W2GN operating position in car. W2GN is frontrunner in OSCARmobiling with his very neat mobile setup on the passenger seat of his car.

AMSAT NEWS

OSCAR 6

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

OSCAR 6 OPERATIONS SUMMARY

A Guest Editorial
by Perry I. Klein K3JTE

OSCAR 6, first in the series of AMSAT-OSCAR-B missions, continues to operate satisfactorily after seven months in orbit. During the first week in May, the operating schedule was modified making the translator available for communications on Thursdays, Saturdays and Mondays, Greenwich Mean Time, and OFF on other days. The purpose of this change was to subject the nickel-cadmium battery to shorter, more frequent charge-discharge cycles. This procedure appears to be working well, and may well extend the useful lifetime of the spacecraft.

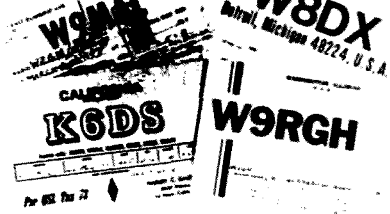
The temperature of the battery, which had risen to as high as 47° C. (117° F.) in early February and had been a cause for concern, has now dropped to a more comfortable value. There is now no reason to believe that we will not achieve the one-year planned lifetime, and possibly even exceed it, although we may find it necessary to further modify the operating schedule from time to time in an attempt to extend OSCAR's operating life to the maximum possible.

As many of the users of OSCAR 6 have noticed, we have initiated AMSAT official bulletin transmissions through the satellite translator, and these are generally given on the reference orbits (the first orbit of each Greenwich day, the same orbit during which the satellite is turned on briefly for telemetry recordings on the OFF days). VE2BYG, K1HTV, W3TMZ and K7BBO have been serving as ASMAT Official Bulletin Stations for these transmissions, which include reports of special experiments and any changes in the operating schedule.

We can now identify the calls of some 1,100 stations who have made one or more contacts via OSCAR 6, very nearly half of these stations being outside the USA. These include stations from 59 countries.

In the United States, all 50 states except Louisiana and Nebraska have been on at one time or another, although more activity is needed in Idaho, Kentucky, Montana, Nevada, Vermont and Wyoming, as only spotty activity has been reported from these states. The number of stations on from each of the U.S. call areas is W1: 38; W2: 64; W3: 47; W4: 64; W5: 34; W6: 91; W7: 53; W8: 30; W9: 61; WØ: 52; KH6: 2; KL7: 5.

The operator apparently leading with the most reported satellite contacts is K7BBO with over 3,300 QSO's (Dave is averaging about 500 satellite QSO's a month), and several stations now have over 45 states confirmed through the satellite.



Early QSL's of W2GN.

We have one report of operation from VE8, and activity in Africa; South America and the Far East also seem to be very sparse. We urge members in these regions to equip for satellite operation during the coming months.

A special message commemorating World Telecommunication Day was transmitted over OSCAR 6's Codestore message storage system on May 17 using the 29.45 MHz beacon.

The first reported aeronautical mobile communication via OSCAR 6 was by W6OAL, who reported working K7BBO April 27th on Orbit 2431 over a distance of approximately 5,000 miles. The transmitter aboard the aircraft was a Gonset Sidewinder operating on SSB with less than 5 watts PEP to a simple whip antenna.

W2GN for the past several months has been quite successful with an automobile OSCAR terminal, and has been very popular with his special state DXpeditions to Vermont and Kentucky to put these rare states on the air. AMSAT is encouraging more mobile terminal operation with OSCAR 6. In particular, operation from small private aircraft, small boats and automobiles (especially on SSB) would provide a very effective demonstration of the usefulness of amateur satellites for small-terminal communication. In addition, operation using totally hand-held equipment or operation from a bicycle or motorcycle would be impressive "firsts," and we urge anyone interested in these activities to give it a try. If possible, make tape recordings of some of the mobile contacts and send them to AMSAT, P.O. Box 27, Washington DC 20044.

WB8LBP

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

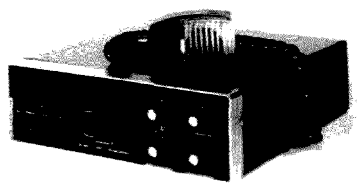
8P6EN is still very active – WB4BND reports the beacon *is* operational on 50.103 from 2130Z to 0030Z weekdays and as time permits over the weekend. Alan has been heard but not worked from the St. Louis area . . . KH6EQI has been worked as far east as Colorado – ask WAØIQN about it. A new Idaho station to look for is WA7FSI. This should relieve some of the pressure on Keith W7UBI. Keith was very much in evidence during the contest. VP2LAW is looking for a Yaesu FTV-650 transverter, and with a little luck will be on the air by the time of publication.

Roberto TG9SO is operating from Guatemala City with a Swan 250 and a pair of 5 element beams. K8REG is now W7JRF/7. WB2TIY is running SSTV on 6 – he was heard (seen) the other evening on 50.150. W7JNK is now signing portable 5. Jim WB4UJH will be running a beacon on 50.105 from Winston-Salem. Whatever happened to Pete VE8BY? WB5FUL says he runs 12 watts of AM to a 3-element CushCraft on 50.42, 74, 55, 70 and 51.45. WA1EXN says Maine had Es openings 8 of the last 9 days of May. Art worked Andy VE4MA twice on the 27th. Hamp K5EFW has been heard here every day for weeks, including while he was working KP4's.

If you don't care for the distortion introduced by the noise limiter in your SB-110, try replacing C54 and C55 with 200 pF capacitors. The limiting action is just as good and the fidelity is greatly improved. There is, by the way, an error in the manual as to the value of these capacitors. The schematic indicates .005, while the construction step says .01.

The early hours of the June contest were almost a complete flop in many areas. Very little Es was noted, leaving only the high power modes to keep things rolling. Scatter and groundwave provided most of the activity. Isn't it amazing how well these modes work when we are forced to use them? Around 2130Z Sunday a reasonable quality aurora improved the situation . . . then another lull. The high point of the weekend was one of the finest Es openings in the memory of anyone. Around 0200Z Monday the band opened from Ohio and Kentucky in the east to California, Oregon, Washington and British Columbia in the west. I have personally never experienced an opening as intense as this. Oldtimers agree there has never been one like it before. W7FN, W7VDZ, W7JRG and a number of others pinned the "S" meters at 60 over 9 for over 4 hours. Fantastic! I might mention that at the same time stations in Indiana, Georgia, Mississippi and points east could be heard reasonably well. Only the severe QRM from the super-loud West Coast prevented more good contacts in that direction.

LINEAR SYSTEMS SBE-50



The SBE SB-50 "SIDEBANDER 6" is an all solid-state 6 meter (upper) SSB and AM transceiver. Frequency coverage is from 50.050 to 50.280 in 23 switched segments of 10 kHz each. The heterodyne oscillator is a frequency synthesized arrangement of 10 crystals combined with the 7.8 MHz i-f to produce the frequency range mentioned. One switch selects the proper pair of crystals to provide any frequency within this range. To cover the frequencies between the 10 kHz points, one of the crystal oscillators is pulled ±3 kHz. This control is labeled "RIT." Turning the RIT control to the extreme counterclockwise position switches off the RIT feature and locks the receiver and transmitter together.

Squelch is provided with a front panel control to set the operating point. At first I thought this was a useless item, but believe me it isn't if you are the type who leaves the rig on for long hours listening for an opening. The only other panel control is the receiver af gain. On/Off, AM/SSB and Noise Blanker In/Out functions are controlled by push-push variety push buttons. Also on the panel is an illuminated meter which reads signal level to 30 over 9 in receive and relative output in transmit.

All tuned circuits normally tuned by panel controls have been broadbanded. This allows instant operation within the stated frequency range without the bother of peaking, tuning and loading. As could be expected there is some compromise involved, but in this case the difference from one end of the range to the other is no more than 3 dB with maximum sensitivity in the normally utilized mid-range. The transmitter output variation could not be noted on the wattmeter. Output on SSB was measured at 10 watts, and the AM output half that. Signal reports over a two-month period averaged about 2 "S" units (or 12 dB) down from the parallel 6146's in the rig used for reference. Alc is included in the transmitter.

The receiver is excellent; good enough, in fact, to make me suspect there was something wrong with my regular rig. There wasn't. The rig was loaned to KØRIR for several weeks so I could hear it and Don experienced the same situation. This rig hears better than I thought was the state of the art.

While intended to operate from an automotive electrical system, it can and was used at the home station with the addition of a small 3 ampere, 12 volt supply. The mobile intent is obvious in the amount of af output available for masking background noise and the lack of VOX circuitry. The noise blanker works extremely well on ignition noise. On SSB or AM, turning on the blanker in the presence of high ignition noise levels produced a full and complete removal of all evidence of the noise. In a rig intended for operation in an automobile this is a necessity to my way of thinking – you will not be disappointed.

There will be those who question the power output level. For Es and local ragchews 10 watts is perfect, but for scatter or groundwave it is somewhat lacking – for that matter so are the 200 watt transceivers. If anything, 10 watts is a more reasonable output level, perfect for driving a linear without swamping loss, and I might add that I experienced no TVI on a cheap, unfiltered TV which goes bananas when my old rig is keyed.

The quality of design, components and workmanship are first class in all ways. The component side of the single PCB is silk-screened with every designation and all internal controls are clearly marked for ease of adjustment, should you ever feel the need. The size and weight remind you of 2 meter FM. Does it sound as if I like the SB-50? It should, because I do.

WAØABI

Even the British Government is trying to get into the act via a recent poster! TNX G3TVI

DX FOOTNOTES

By, Gus M. Browning, W4BPD
Drawer "DX"
Cordova, S.C. 29039

Here we are right smack into summertime and from all I can hear the real serious low frequency DX'er is still working DX on both 160 and 80 also on 40 meters. 10 has more or less "had it" this summer and 15 has even got a little "shaky" as far as rare DX is concerned. Those Ole Sun Spots is gradually catching up with us I would guess. Even the CB gang has complained that they are not working "skip" very good now. (this makes me very sorry for them!)

Now is the time to do whatever you have been "thinking about" doing all winter with your antenna or antennas because it will soon be fall and then winter again, and you will never get it done.

Did you ever want a great circle chart from your QTH ? Well it is now possible to get one for a measley $ 1.00 worldwide or via air mail for $ 1.75 if you send it to:
WB5CBC, William D. Johnston
1808 Pomona Drive
Las Cruces, New Mexico 88001
Give him your name and address.
The city for which the chart is wanted.
Include your state or country too.
If the population is less than 10,000 or if the location is a rural area also include the latitude (indicate north or south) and longitude (east or west) in degrees and minutes. (phone your local airport or some surveyer).
Charts are centered on more than 2,000 cities and towns. 660 DX points are given in degrees from true north. If you use a rotary beam this will help you point it the right direction.

I have received many complaints on the Mt. Athos DXpedition of a few months ago (probably from fellows who didn't get a contact ! ?.) The biggest complaint seemed to be their selection of their SSB frequency on the 20 meter band. When they were on 14200 and using TRANSCEIVE the fellows were in "trouble", if they operated a few kc up inside the W part of the band they didn't get a contact, if they got on 14200 they may have got a contact from both FCC and the DXpedition ! I myself didn't hear any of the operation, I am only reporting the dope I received from some of the gang. Their 40 meter CW operation was good and that's where many fellows got their Mt. Athos QSO. I would very strongly suggest that DX stations either get up very definitely INSIDE the W/K part of the bands if they are "stuck" with a transceive deal, but BY FAR it's much better to get WELL OUTSIDE our part of the band and USE SPLIT frequency. Of course if you can handle the gang in the pile-up and get them to OBEY your instructions (if they hear them), then (in a push), use your transceiver and good luck to you, but GIVE ME SPLIT FREQUENCY every time, because when I have went to all the trouble to be DX, I WANT LOTS OF QSO'S-FAST !

XV5DX - Anyone know if this station is actually in Viet-Nam for sure ? He mentioned QSL via K9VF. I have my "doubts" about the whole thing, BUT, I might be wrong. Good luck to you who got a QSO, I hope he was good and I hope you got his QSL (but I doubt it !)

Then there was another station on signing XV5AD - I don't know "nothing" about him either - DO YOU ?

What is DX anyhow ? My answer to this question is very simple. It's any country that YOU have not worked. While I am on this subject of what's DX - Sure would like to get a list from EVERY READER of the countries he need to have "worked all of them". This would help Peggy and I to more or less "select" where we should go on our next year's DXpedition (funds permitting, of course.)

SIKKIM - I wonder if anyone knows what's happening up there since their "big trouble" this past spring ? Sure hope the Maharaja and Maharanee are doing well. They are such fine people and I am sure he would like to fire up AC3PT again, and so would thousands of DX'ers.

BHUTAN - A51PN was trying for his WAS last spring. In April he still needed these states for WAS: Alabama, Alaska, Arizona, Colorado, Hawaii, Idaho, Iowa, Kentucky, Louisiana, Maine, Maryland, Mississippi, Nevada, New Hampshire, North Carolina, Rhode Island, South Carolina, (wish I had up a good beam and some decent power !), Vermont, Wyoming, He hangs out around 14070+— and has been worked from starting 1200z.

CHINA — According to the info I received in late spring they are starting what's called an "Amateur Radio Service" in the Peoples Republic of China. The call signs will be BD1 - BE1 - BF1 etc. All sounds OK since the calls are in the right block BAA to BZZ for China. Sure will be FB, writing down in your logs such places as Sian, Peking, Hangchow, Lanchow, Shanghai, Canton, etc.

THE LACCADIVES: Anything "cooking" from over there lately ? Must be about time for one of the VU2 boys to hit this rare spot again and get some "action" going on the bands again !

HAVE YOU A SECRET METHOD OF GETTING THAT RARE QSL ? Wanna spill the beans to me and I will tell the boys about it and it wont be a "secret" anymore - This I promise you for sure.

WTW AND 73-73-73 AWARD: Yes we are giving out these two awards. Work 100 (or more) countries, get a QSL from them, send me your cards (via registered mail or at least certified mail) and $ 1.00 if you want them back ! Or send them to our nearest Verification Point for your area (we have a few). We will do the rest and get your certificate off to you. THE 73-73-73 Award is easy to get. Check your logs for 73 worked countries in the first 73 days of 1973. Get three hams or a ham club to verify your list, send it to me along with $ 1.00 to help with expenses, I will do the rest Ole Buddy. This is a "once per lifetime" award since the year 1973 is 73 Magazine's year we want to let the radio world know about it by issuing these 73-73-73 certificates (Wayne Green said, "This is OUR YEAR", and I believe him ! (write him a "nasty" letter if you don't agree with him, he likes to get plenty of mail, ANY KIND !

Any of you who knows of any DX event that's planned a few months in advance how about dropping me a note so that I can pass the info to the gang. Sure would appreciate it a lot. Or maybe you have other info little DX tidbits that you think the fellows would like to know about. Little items like these are always needed and appreciated here. Thanks.

FOR A BETTER QSL RETURN: I have been told that the COLOR of your QSL card has a bearing on the percentage of cards answered ! At first this made me laugh out loud. In fact I still think someone is trying to "pull my leg". I wonder if some of you out there can verify this story, one way or the other ? I am sure though that if you have a nice fancy card, maybe one showing the room full of pretty, expensive gear, a big, expensive looking house, a nice list of the gear you use, a big antenna etc. You had better not send this kind of card to certain countries, especially those that have a central bureau. They will somehow become "lost" along the line and if the station is one that only answers QSL cards you are stuck - NOT UNLESS you have a few cheap looking cards to send out. A card with just the smallest amount of info on. Gus BPD

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

Aug 4-5	Illinois QSO Party
Aug 18-19	New Jersey QSO Party
Aug 18-19	QRP ARC Contest
Sep 8-10	Four Land QSO Party
Sep 15-17	Pennsylvania QSO Party
Sep 29-Oct 1	Delta QSO Party
Oct 6-7	New Mexico QSO Party
Oct 13-14	RSGB 21/28 MHz Telephony Contest
Oct 20-21	RSGB 7 MHz CW Contest

THIS MONTH

Illinois QSO Party

Complete rules appeared in last month's "Contest Calendar." Your editor finished first in Ohio in the 1972 contest.

New Jersey QSO Party

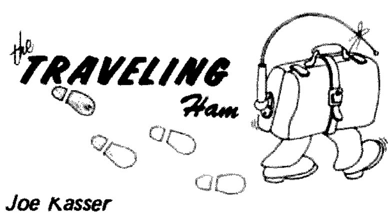
From 1900 GMT August 18 to 0600 GMT August 19 and from 1200 GMT to 2300 GMT August 19. Phone and CW are the same contest. A station may be contacted once per band and once per mode. Suggested frequencies are 1810, 3535, 3735, 3905, 7035, 7135, 7265, 14035, 14280, 21100, 21355, 28100, 28600, 50–50.5, 144–146. Exchange QSO number, RST and QTH (ARRL section or country,, or county for N.J.). For non-N.J., multiply total QSOs with N.J. by total N.J. counties worked. For N.J., W-K-VE-VO QSOs are 1 point; DX count for 3. Multiply total QSO points by total ARRL sections. (NNJ, SNJ count as sections too.) KP4, KH6, KL7, KZ5 count both as 3 point QSOs and as section multipliers. Appropriate certificates. Logs must show GMT date and time, band, mode, exchanges, and scoring. Logs must be received no later than September 15, 1973. Miscellaneous: Indicate and number the first contact for each claimed multiplier, and attach a check sheet of QSOs and multipliers. Multi-op entries must show calls of all participating operators. Mail logs and comments (and a size No. 10 SASE if results are desired) to Englewood Amateur Radio Association, Inc., 303 Tenafly Road, Englewood NJ 07631.

QRP ARC Contest

From 2000 GMT August 18 to 2400 GMT August 19, 1973. Open to all hams. Call "CQ QRP." Exchange RS/T, State/Province/Country, QRP number if member (non-members send "NM"), and Power. Stations may be worked once per band for QSO *and* multiplier credit. QSOs with members are 3 points, QSOs with non-members count 2. Power multipliers (output power) – more than 100W (200 PEP) – X 1, 25 to 100W – X 1.5, 5 to 25W – X 2, 1 to 5W – X 3, less than 1W – X 4. Multiply total QSO points by total States/Provinces/Countries on each band, then multiply by your power multiplier. Suggested frequencies are 3540, 7040, 14065, 21040, and 28040 kHz on CW; 3980, 7280, 14330, 21430, and 28600 on SSB. Novices try 3715, 7115, 21115, and 28115. Appropriate certificates. Send full log data, including band, equipment, power input/output, and a signed statement that contest and government regulations were observed. Log deadline is September 25, 1973, and logs go to Jim Hadlock K7JRE, Contest Chairman QRP ARC-I, 3701 S.W. Morgan St., Seattle WA 98126.

Well, gang, the column seems to be coming along rather nicely. Next month we will report on five big contests and possibly more than that. Judging from comments so far, this column is a welcome addition to 73. If you have any comments of your own, or questions, feel free to write. If you have info on an upcoming contest that you would like to see announced here, please get it to me 3 months prior to the date of the contest at the very least. Correspondence should go to Tom DiBiase WB8KZD, 708 6th Ave., Steubenville OH 43952.

WB8KZD



Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

The first night that we spent in New York City, the locals welcomed our car by removing the gas tank cap. Perhaps that was my fault for putting temptation in their way by parking my car with its out-of-state plates on the main road through the campus of Yeshiva University in Washington Heights.

Luckily I had some "green tape" in the car, and was able to repair the damage so well I was able to drive around the city also return to Washington in the rain. This green tape is made by "Scotch" and is almost the same stuff that the astronauts used on the moon. It is also very useful here on earth in the mobile station for holding rigs and cables in place. It also makes great insulating tape. It is also useful in covering holes in the car and supporting parts that are about to fall off. When covering the gas cap hole, put a piece of paper over the hole under the tape because the petroleum fumes may dissolve the adhesive in the tape and it may end up in the engine.

After the gas cap episode I did not trust the locals. I even took the AA10 amplifier out of the car as well as the TR-22 each time I left it, instead of tucking it under the seat as I normally do. They could have the car, but the rig – never!

New York City is a friendly place, at least to visiting hams. There is lots of activity on two meter FM. While there over a holiday weekend I was able to work through repeaters on 34–94 (Greenbrook NJ) 28–88 (Staten Island), and 25–85 (Long Island). WR2AAA in Manhattan is on 147.73 in, 146.74 out, so having borrowed 13–73 from W3ATE I was able to listen but had to remain silent. NYC also has a 16–76 machine with autopatch, but it needs a PL tone for access.

The XYL and I drove to the Skyscraper City from the Nation's Capital. As we drove, we worked through a number of two meter repeaters. The 28–88 repeater in Greenbelt MD is workable while driving along I-95 from the Washington Beltway to the Baltimore Beltway using nothing more elaborate than a TR-22 and a 5/8λ antenna on the trunk. The 16–76 Baltimore repeater is being moved around and at this time coverage seems to vary from day to day. I did work through it near Baltimore, but the coverage was not too good, even with the 10 watt amplifier. They will be moving it again soon.

Driving up the John F. Kennedy Tollway (I-95) we refreshed ourselves at a service station called the Maryland House, and lo and behold, there was a repeater on 25–85 within range. Not only was it within range, but it was loud and clear. That machine is located at Havre de Grace, Maryland, a few miles up the road. The locals are a very friendly lot and are always willing to talk to and assist passersby. Further up the road we came into range of the 13–73 device in Wilmington, Delaware. This repeater has extremely good coverage. I was able to work it well into New Jersey and from various Philadelphia suburbs on the return trip. The identification is something else. They have a sexy female-type voice identification well worth listening to.

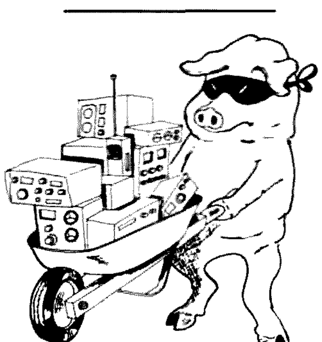
Driving over the Delaware Memorial Bridge we were able to key up the 28–88 in Washington but nobody came back. I know that contacts are possible, because I've heard others break that repeater from out there. Soon we came into range of the 34–94 at Valley Forge. The 34–94 channel was busy all the way to New York; as soon as Valley Forge dropped out, Greenbrook NJ came in.

Driving past Cherry Hill on the New Jersey Turnpike I was able to work through the 16–76 Philadelphia repeater. It only seems to cover the southeastern part of the big city. Although it was good on the outward journey, I had problems getting into it from the northern suburbs on the way back. The next repeater to come into range was the 31–91 Tom's River machine with its female voice ID, at about Exit 8 on the Turnpike. I was able to put a good signal into it except when overtaking trucks. The S meter used to drop from full scale to zero as we passed the truck, and come back up again as the truck was left behind.

At about Exit 8A I was able to work through the 28–88 Staten Island repeater and was hearing all the New York City repeaters that I had crystals for except the 25–85 which did not become audible until Staten Island and workable until Brooklyn.

New York City is a great place to visit, but it costs a lot to get there. Back in the eighteenth century New York City was surrounded by highway men and footpads. In the twentieth century they legalized them and call them toll gate keepers.

G3ZCZ/W3



The Hamburglar STRIKES AGAIN!

Larry Briggs W3MSN had a Drake ML-2, Ser. No. 10582 stolen with his VW Campmobile last June. The ML-2 has a broken on/off switch which should help identification. Larry can be reached at 5108 Boulder Dr., Oxon Hill MD 20021. 301-894-3977.

A Tektronics 453 oscilloscope was lifted on 6/3/73 from Bill Voight WB2FZU. Any information leading to its recovery will be greatly appreciated. Bill can be contacted at 18141 Frank, Apt. 103, Roseville MI 48066.

List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
AF68 No. 10888	K5LKL	1/73
PMR8 No. 10918		
M1070 pwr supply		
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA6WOA	4/73
NPC 107m pwr supply		
2, 5AJ-IPL Onan Gen., No. 327885		
R4B No. 11578G	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8390		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0653556		
HR-2 No. 04-C2879	W6GSR	6/73
SB-34 No. 211828		
STD 826 No. 011268	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G12279/CW	W4GF	7/73
HR-2 No. 0302030		
Clegg 278 No. 72013-1068	W3BXL	7/73
Std 826MA No. 208078	WB2DEW	7/73

Looking West

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

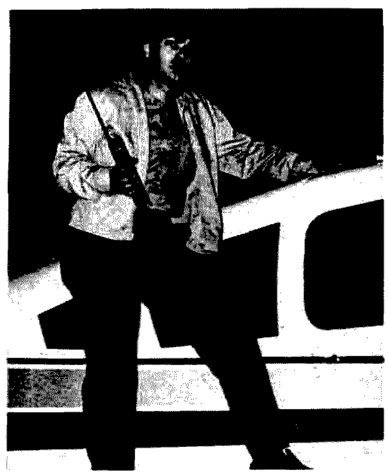
Many repeaters throughout the country are either owned by or associated with a given radio club. We all know this. But how many of these clubs have their own air force? To date I know of only one, the Pallisades Amateur Radio Club. Now, while most air force organizations throughout the world spend their time on matters of military importance to their respective governments, the PARC Air Force, as it has been unofficially dubbed, spends its time uniting private flying and ham radio. It was therefore more than a pleasure to accept an over-the-air invitation the other evening, and participate in one of their "reconnaissance runs" up the coast for dinner.

Normally on a Friday evening, anywhere from three to ten aircraft will partake of the festivities, but this evening it was to be a solo affair with Rod Dixon K6YTS as pilot in command. Since this was to be a photographic mission as well, we decided on a Cessna Cardinal as the best choice of flying machine, due to its high-wing

Rod Dixon K6YTS preflights our Cardinal.

strutless design. I must admit I was a bit apprehensive about taking a Cardinal, since some years ago Larry WA2PZI and I (and our instructor) found that the particular "bird" we had taken to East Hampton remained glued to the runway well after the airspeed indicator said that we should be airborne. That though, was an older model, and the new one with its 180 hp power plant and constant-speed propellor is far and away the kind of plane I would love to own some day. As I found out on the return trip, this 180 hp Cardinal handles amost as easily as a 150 trainer when properly trimmed.

We departed southwest out of Van Nuys and across the Santa Monica Mountains, located the shoreline of the Pacific and followed it north-northwest to Santa Barbara. Not to ignore the other part of this venture, Mortie WA6SNE brought along his Standard 146 and hammed along our route. It reminded me of happy days not so many years ago when Larry, Hank K2SSQ, Lou K2VMR, myself and others would join Jim WA2CPX and his Aero Commander 560 for our



Now you know what a WA2HVK/6 looks like.

73 REPEATER ATLAS REGISTRATION

REPEATER CALL* (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID—TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

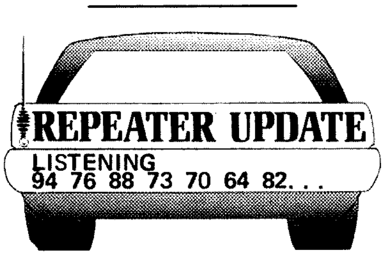
Sunday morning air-mobile adventures on 6 meter SSB and 2 meter AM. This was in pre-FM days, and I guess we were something of a novelty then. Now 3,000 miles away we were doing it again, only the Swan 250 and Gonset 1V had been replaced by a small hand-held unit with its own antenna. The people and aircraft were different, but the feeling was the same. After dinner we were airborne again, our destination Long Beach, to photograph the Queen Mary now permanently anchored there. She was a beautiful sight, all lit up like a Christmas tree. I took my pictures and then it was back again to the San Fernando valley for a "greased on" landing at the skillful hand of Rod. An evening with the "PARC Air Force" had come to an end, all too soon. This is but one of the activities that makes the Pallisades Amateur Radio Club one of the most successful amateur organizations today. They work hard at having a good time.

Since there is a lot to cover, and little space left, the following are Southern California Quickies I will elaborate on in coming months. It has been unofficially reported that Northern California has adopted a 220 band calling for 1.6 MHz split and 40 kHz separation. By the time this gets into print the SCRA will have met and released its decision for this area. The on-the-air opinion is that we will go the same route, *but* with option to split separation to 20 kHz in the future.

I had a peek at the new "fully synthesized" ICOM IC 200 two meter rig at the Lockheed ARC hamfest. It's quite a little radio. That's Max K6GLG of ICOM FM Sales demonstrating it in the picture.

The auto-MCW being heard on 223.0 is both a beacon and "smoke

(Continued overleaf)

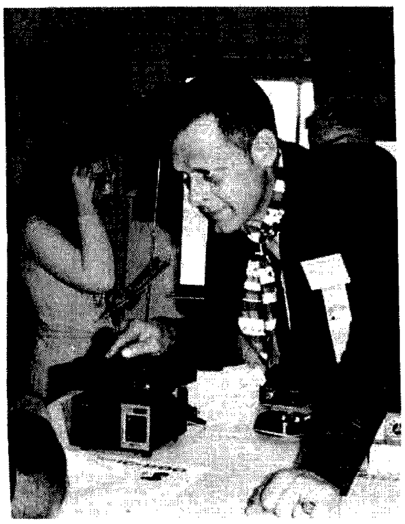


FCC WORKS OVERTIME!

CA	WR6ABB ex WB6ZDI	Los Angeles	01–61
CA	WR6ABD	Sen Jose	04–64
CA	WR6AAC/6 ex WA6ZZE	Los Angeles	37–97
CA	WB8AAE	Oakland	22–82
CA	WB6NDJ	Oakland	28–88
CT	WR1ABE ex WA1JTB	Bridgeport	146.295–146.895
GA	WR4ABC ex WB4UZY	Atlenta	37–97
ID	WR7ABA ex W7CTX	Boise	28–88
IL	WR9ABH ex WB9AET	Western Springs	223.30–224.80
IL	WR8ABB ex WB9INL	Hinsdale PL 107.2	07–87
IA	WRØABO	Dubuque	34–94
MD	WR3ABB ex WA3SFG	Greenbelt	28–88
MD	WR3ABC ex WA3KWG	Cheverly	01–61
MA	WR1ABB ex K1AIU	Framingham	146.55–147.15
MA	WR1ABI	Fall River	52.010–52.700
MA	WR1ABJ ex WA1KHB	Weston	22–82
MA	WR1ABG ex K1CRR	Webster	28–88
NH	WR1AAB	Peterborough	146.19–146.79
		↗Tandem operation on 2m↘	222.34–223.94
			444.10–449.10
VT	WR1AAB	Mt. Equinox	146.19–146.79
NJ	WR2ABN ex WB2LPV	Oakland	10–70
NY	WR2ABE	Port Chester	34–94
OR	WR7ABE ex K7SJQ	Portland	444.17–449.17
PA	WA3KXG	Etters	16–76
PA	WR3ABD ex WA3CAG	Richboro	19–79
TX	WR5ABB ex WA5UFL	Seguin	34–94
TX	WR5ABC ex W5FDE	Victoria	16–76
TX	WR5AAA ex WA5YUX	Houston	28–88
WA	WR7ABC ex W7RC	Renton	22–82
WV	WR8ABB ex K8MYU	Fairmont	28–88

CANADA

BC	VE7VAN	Vancouver	147.72–147.12
ONT	VE3TTY (Teletype only)	Toronto	10–70



Max K6GLG demonstrates new ICOM IC200 rig.

test" for the ICOM FM Repeater Club transmitter. By the way, it looks as if L.A. will finally have a 34–94 repeater, 223.34–224.94. That's the pair that the aforementioned group will be operating.

The WA6LNU 220 MHz AM repeater is temporarily off the air. I met Lynn at lunch the other day, and he told me he took it off for both time factors and to update it. It will be back on in the future – possibly FM.

Communications for the Baja auto race will be handled by amateur radio this year, both lowbands and a bit of two meter FM. A group from this area is heading south of the border to work on this project. Will report results soon.The San Fernando Valley ARC is planning an open 450 MHz repeater if they can gain the necessary support. It will be the only one of its type in the L.A. area to my knowledge. Hope they go through with their plan.

I have received letters from a number of readers commenting on the "break in" standardization system discussed in my June column. Seems 50% for and 50% negative. Will discuss further next month.

I have heard from Doc W2BIV, Gene K2AKV and Lou K2VMR of my old Brooklyn group and have a lot more info on the situation concerning WA2ZWP and why it finally failed. I have to agree with Gene in part when he says that a schism developed between the technical people and the administrative people within the organization. In a letter too lengthy to reproduce here, he went to the task of giving me a point-by-point description of all the events that took place since my move to L.A. forced me to vacate my position with the organization. The more I learn, the more I am convinced that no one person can be held responsible for the situation. Though Gene, as site committee, acted as the final decision-making agent in the repeater leaving the air, he was put in a position that offered him little choice. Rather than continue here, I am preparing a separate article that will detail what happened to us in the hope others can learn from our mistakes. In the meantime I wish Lou and the new leadership the best success in reviving the Brooklyn machine. One piece of advice, keep the administration people separate from the technical people. Let those capable of leadership assume that role, and those who are technically oriented maintain and improve the machine.

WA2HVK/6

SOCIAL EVENTS

NATIONAL SCOUT JAMBOREE

Special amateur radio stations will be in operation at each of the two Scout Jamboree sites: Farragut State Park, Idaho, and Moraine State Park, Pennsylvania. Three separate operating positions are expected to be manned almost continuously, using the special events call signs KJ7BSA July 28–August 9 from Idaho, and KJ3BSA July 30–August 11 from Pennsylvania. QSL requests accompanied by a stamped, addressed envelope may be directed to 225 Main Street, Newington CT 06111. All other contacts will be confirmed via the bureau. Suggested frequencies for finding KJ3BSA and KJ7BSA are 5 kHz above the lower limit of the General and Novice subbands: for example, 3530, 3705, and 3895 kHz on 80 meters.

1973 INTERNATIONAL FIELD DAY

The Burlington Amateur Radio Club, Incorporated, Burlington, Vermont, will sponsor the 1973 International Field Day at the Old Lantern, Charlotte, Vermont, on Sunday, August 19, 1973. Registration is $3.50 at the gate, $3.00 for Early Birds – write to Bob Sanford W1FIS, South Hero, Vermont 05486.

CENTRAL IL - DOINGS

East Central Illinois' finest hamfest. Sunday, September 2 at Douglas Park in Danville, Illinois. Take the Bowman Avenue exit off Interstate 74 and follow the signs. Flea market will open at 6 a.m. Drawing at 3 p.m. Talk-in on 34/94. Camping facilities nearby. Write WA9IAC, 1615 N. Bowman, Danville, Ill. 61832.

NH ANNIVERSARY

To celebrate the 350th anniversary of the first settlement in the State of New Hampshire the special events station WP1ORT will operate during the period 1–19 August 1973. Modes of operation will be CW, SSB and SSTV. Probable phone frequencies are 14.230 (SSTV), 14.300, 7.250 and 3.925 MHz. QSL with S.A.S.E. or S.A.E. and IRC to P.O. Box 1973, Portsmouth, New Hampshire 03801.

KNRC HAMFEST

The Kansas, Nebraska Radio Club, Concordia, Kansas, presents their 22nd annual KNRC hamfest on Sunday, August 5, 1973, at the Moose Building, 113 W. 5th St. There will be a mobile talk-in on 3920 kHz and on 146.94 or 94–34 repeater. Bring your favorite covered dish, free soft drinks, swap tables. Registration begins at 9:00 a.m.

ZERO-BEATERS ARC

Washington, Missouri – Zero-Beaters ARC annual hamfest, August 5, over $700.00 prizes. Ham auction, large Traders Row, entertainment for XYL and children. St. Louis ARC Ham of the Year award. Missouri Army MARS Meeting. Write Zero-Beaters ARC, Box 24, Dutzow, Missouri 63342 for tickets and information.

INDIANA RC PICNIC

August 19 at the Tippecanoe County Fairgrounds, located at 1100 Teal Road (indiana Route 25), Lafayette, Indiana. This is a family hamfest. Flea market, games, trailer parking, awards, and morel Tickets from any IRCC club, by mail, or at the gate. Tickets by mail from WB9FOT, 2233 Delaware Drive, West Lafayette, Indiana 47906. All tickets $2, but if purchased by August 1 owner is eligible for pre-registration prize of a Motorola HT 220.

KNIGHT RAIDERS

The Knight Raiders VHF Club, Inc., K2DEL, will be holding its seventh annual hamfest on Saturday, August 11, 1973, starting at 10 a.m. at the YM/YWHA Camp, Rifle Camp Road, West Paterson, New Jersey. Gigantic flea market and auction, swimming and boating. Pinic tables and BBQ pits available. Contests, door prizes, displays. Refreshments will be available. Navy MARS meeting. Talk-in 94 FM, 145.71 AM and 50.200 SSB. Tickets $1.00 in advance, $1.50 at the door. Children under 12 free.

For more information and tickets contact: Knight Raiders VHF Club, Inc. P.O. Box 1054, Passaic, New Jersey 07055.

SHENANDOAH VALLEY

The 23rd annual hamfest of the Shenandoah Valley ARC will be held in Winchester, Virginia, August 4th and 5th. Our program will consist of a banquet on Saturday evening and an all-day session on Sunday in the Winchester Armory. Contact L. Neill Woods, W4LOG, Box 139, Winchester VA 22601.

75M PICNIC

Marshalltown, Iowa – The annual Iowa 75 Meter Net potluck picnic will be at Riverview Park on August 26, 1973. Swap Tables – Prizes. Serving at noon. Coffee and pop furnished. Everyone is welcome.

MN Hm-Fst

The St. Cloud ARC is having their hamfest on Sunday, August 12. Place – Sauk Rapids Municipal Park, Sauk Rapids, Minnesota. $1 registration, rain or shine. Refreshments, games, transmitter hunt, gear swap, etc. For further info contact Gary WNØGSE and/or Lolly WNØGSD Loomis, Box 103, Clear Lake, Minn. 55319.

SIERRA HAMFEST

The Sierra Hamfest will be held on Saturday, August 18, 1973, at the California Bldg. in Idlewild Park, Reno, Nevada. For further information contact George V. Lyle K7ZAU, 1047 Mark Way, Carson City, Nevada 89701.

TACOMA HAMFAIR 73

The Radio Club of Tacoma presents "Hamfair - 73" Saturday and Sunday, August 18th and 19th, at the Pierce County Fairgrounds near Graham (directly south of Puyallup on Meridian Avenue) – manufacturer's displays – technical seminars – games – contests – prizes – bunny hunts – swap shop – snack bar – Registration including Saturday evening dinner – $6.00. (Advance registration only) Registration at door or without dinner – $3.00. Tent, trailer, or camper space $1.50 per night. Sunday Logger's Breakfast $1.50. 3965 kHz and 146.76 MHz monitored for mobiles. Contact registration chairman – Emil Koth, K7GPF, 13616 10th Avenue East, Tacoma, Washington 98445.

SIX METER CLUB HAMFEST

The Six Meter Club of Chicago Inc. will hold its 16th annual picnic and hamfest on Sunday, August 5th at the Frankfort Picnic Grove, 1 mile north of U.S. 30 on U.S. 45 Frankfort, IL. Food and drinks will be available, Swap and Shop section provided. Advance registration $1.50. Admission at gate $2.00. For tickets and further information contact Val Hellwig K9ZWV, 3420 South 60th Court, Cicero, IL. 60650.

KENTUCKY HAMFEST

The third annual Greater Louisville hamfest will be held August 26, 8:00 a.m. to 6:00 p.m. at the Oldham County Fairgrounds, LaGrange, Kentucky, on S.R. 146 off I-71. Admission and registration $1, flea market $1. Five major prizes, door prizes, ladies' program, food and refreshments, plenty of parking. Contact: Guy E. Partridge, K4KZH, 8276 Walker Road, Louisville, 40258.

R.S.O. ANNUAL CONVENTION

The annual convention of the Radio Society of Ontario Inc. will be held on 17, 18, 19 August 1973 at Queens University, Kingston, Ontario. This is the major amateur event in Ontario. R.S.O., C.A.R.F., and A.R.R.L. Forums, technical forums, banquet, demonstrations, displays, prizes, social events, etc. Accommodation is available at Victoria Hall (on campus) and a trailer park is located at nearby Lake Ontario Park. Check the 'CJ' net nightly (3790 kHz, 2230 GMT) for details or write Kingston A.R.C., P.O. Box 1402, Kingston, Ontario for full information.

TEXAS SWAPFEST

The eighth annual Northest Texas Emergency Net Picnic and Swapfest will be held at the City Park in Levelland, Texas on Sunday, Aug. 5, 1973. Bring your own picnic basket. Free registration begins at 0900. Lunch at 1300. Swapping all day. Mobile talk-in frequency is the net freq. 3950 kHz 28–88, 34–94.

NORTH AL HAMFEST

The North Alabama hamfest will be held in Decatur, Alabama August 19, 1973. For information write North Alabama Hamfest Assn. Inc., Box 9, Decatur, Alabama 35601.

HUB CITY SD

The Hub City Radio Club of Aberdeen, South Dakota, is sponsoring the annual South Dakota ham picnic August 4, 1973 at Wylie Park, Aberdeen, from 10:00 a.m. to ??? Prizes, flea market, activities for XYL and Jr. Ops. Limited camping available. For information or tickets contact: WØOGS, 1017 7th Ave. S.W., Aberdeen, S.D. 57401. Talk-in on 3955 kHz and 146.94 MHz.

FCC NEWS

220 MHz NEWS!! – See p. 36.

STUDY QUESTIONS

Following is a list of study questions provided by the FCC for Novice element 2 examination:

NOVICE

Rules and Regulations

1 What is the Amateur Radio Service?
2 What Part of the Federal Communications Commission's Rules govern the Amateur Radio Service? What are the maximum penalties for violating those rules?
3 The Rules encourage and improve the Amateur Radio Service by providing for advancing skills in what two phases of the radio art?
4 What is the definition of an amateur radio operator? Of an amateur radio station?
5 For how long is a Novice Class license valid? May it be renewed?
6 May a transmitting station be operated in the Amateur Radio Service without being licensed by the Federal Communications Commission?
7 Who may hold an amateur radio station license?
8 Where must an amateur radio operator license be retained? An amateur radio station license?
9 Who is responsible for the proper operation of an amateur radio station?
10 What is the definition of a control operator? Who may be the control operator of an amateur radio station?
11 What is the log of an amateur radio station? What information must it contain? How long should it be preserved?
12 What are the frequency privileges authorized to Novice Class licensees?
13 What are the emission privileges authorized to Novice Class licenses?
14 What is the maximum transmitter power privilege authorized to Novice Class licensees?
15 What are the Rules regarding the measurement of the frequency of emissions from an amateur radio station?

Radio Phenomena

1 How fast do radio waves travel in free space (in meters per second)?
2 What is the relationship between the frequency and the wavelength of a

(Continued on p. 16)

(Continued from p.13)

radio wave? What are the approixmate wavelengths for the frequency bands available to Novice Class licensees?

3 How are radio signals transmitted across great distances? Which of the amateur radio frequency bands available to Novice Class licensees are most likely to result in long distance communication during the daylight hours? At night?

Operating Procedures

1 When transmitted by telegraphy, what is the meaning of each of the following: CQ, DE, K, AR, SK?

2 What is the RST reporting system? What is the meaning of "RST 579?"

3 What are "Q signals?" What is the meaning of QRM? The meaning of QRS? The meaning of QRU? The meaning of QRZ? The meaning of QTH? The meaning of QSL?

4 In what manner should a transmitting frequency be selected for an amateur radio station? What additional factors should be considered when selecting a transmitting frequency near one end of the authorized frequency band?

Emission Characteristics

1 What is an A1 emission?

2 What are the characteristics of a good quality A1 emission?

Electrical Principles

1 What is electromotive force? Current? Electrical power? What are their units of measurements?

2 What is direct current? Alternating current? How can alternating current be converted into direct current?

3 What is a cycle? A kilocycle? A megacycle? A hertz? A kilohertz? A megahertz?

4 What is "r.f.?"

5 What is the relationship between a fundamental frequency and its second harmonic? Third harmonic?

6 What is: Resistance? Inductance? Capacitance? What are the units of value for each?

Practical Circuits

1 Draw the schematic diagram of a circuit having the following components:
(a) battery with internal resistance
(b) resistive load
(c) voltmeter
(d) ammeter

2 From the values indicated by the meters in the circuit above, how can the value of the resistive load be determined? How can the power consumed by the load be determined?

3 In the circuit, what must the value of the resistive load be in order for the maximum power to be delivered from the battery?

4 Draw the schematic diagram of an r.f. power amplifier circuit having the following components:
(a) triode vacuum tube
(b) pi-network output tank
(c) high voltage source
(d) plate current meter
(e) plate voltage meter
(f) rf chokes
(g) bypass capacitors
(h) coupling capacitor

5 What is the proper tune-up procedure for the circuit?

Circuit Components

1 What is an insulator? A conductor? A semiconductor? Give an example of each.

2 Draw the schematic symbol of a resistor, a capacitor, an inductor, a transformer, a choke.

3 Draw the schematic symbol of a diode. A transistor. A triode vacuum tube.

Antennas and Transmission Lines

1 What is a dipole antenna?

2 What is a half-wave antenna? What are the approximate lengths (in feet) for half-wave antennas for the frequency bands authorized for Novice Class licensees?

3 What is a transmission line? What are some commonly-used transmission lines?

4 What are some advantages of a multiband antenna? The disadvantages?

Radio Communication Practices

1 What precautions can be taken to reduce the possibility of shock hazard in amateur radio stations?

2 Draw a schematic block diagram of an amateur radio station having the following components:
(a) receiver
(b) speaker
(c) transmitter
(d) telegraphy key
(e) transmission line
(f) antenna
(g) ground rod
(h) transmit/receive antenna switch

3 What is the purpose of each component in the schematic block diagram?

4 What is the power input to a vacuum tube in the final amplifier stage of a transmitter, exclusive of power for heating the cathode, for the following operating conditions:

Driving power	0.5 watts
Plate voltage	600 volts
Plate current	140 milliamperes
Screen voltage	175 volts
Screen current	10 milliamperes
Filament voltage	6.3 volts
Filament current	0.8 amperes

5 What methods are most often used by amateur radio licensees for determining that an emission line from a transmitter is within an authorized frequency band?

6 What methods are most often used by amateur radio licensees to determine the quality of emissions from their stations?

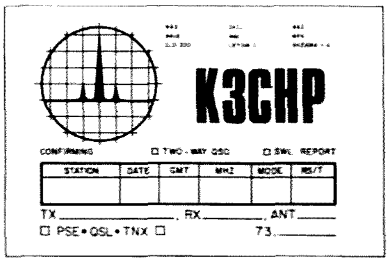
7 What is a transmatch? What are the advantages of using a transmatch?

FIJI -- JORDAN

ARRL Headquarters announces that a reciprocal operating agreement has been signed between Fiji and the U.S., this actually being an extension of the privileges existing under the agreement signed with Britain.

Also signed has been an agreement for the handling of third-party traffic between the U.S. and Jordan.

QSL CONTEST



Joseph Mikuckis K3CHP, 6913 Furman Parkway, Riverdale MD 20840, wins this month's QSL Contest and a one year subscription to 73. Send your entry to *QSL Contest, 73 Magazine, Peterborough NH 03458.*

15 WATT AMPLIFIER

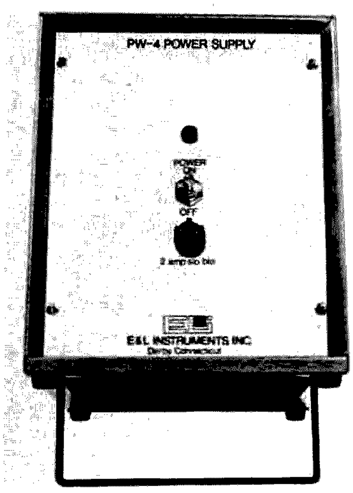
A compact 15W 2 meter amplifier has just been added to VHF Engineering's line of FM equipment. The PA-1501 H is available in either kit form for those who like to build, or wired and tested for those who are looking for a fast way to increase the power of their 1-2W mobile rig. The amplifier features solid state switching (less than 1 dB loss on receive) and operates from your automobile's 12V power supply.

Although it can be used with any low power FM rig, a nice little 15W transmitter can be had by matching the amplifier with VHF's TX-144, a 1W transmitter kit they sell for $29.95. Since the amplifier kit sells for $39.95, the total cost of a complete 15W rig is $69.90 – not bad! The cost of the wired and tested amplifier is $49.95.

The amp is a perfect match for transceivers of the TR-22 class. It can be permanently mounted in the car to boost your signal strength, while letting you retain the transceiver's portability as the only connection to the rig is via antenna cable.

For information on the PA-1501 H and other FM products, write *VHF Engineering, 320 Water St., POB 1921, Binghamton NY 13902.*

10 AMP SUPPLY



E&L Instruments, Inc., has developed a new power supply, designed primarily for home operation of mobile equipment. The unit, called the PW-4, produces enough power to operate both an FM transceiver and an amplifier simultaneously. The PW-4 uses 110–120V ac input power, and produces a rated output of 13V dc at *10 amps*, I.C. regulated to ±3%. This increased power capability means that high power mobile units can be taken into homes for use atnight. The supply features a modern cabinet design, current limiting, and reliable heavy duty components.

It can be used with most 12–13V dc transceivers, together with 50–60W amplifiers. The PW-4 is available direct from the factory, or local distributors. For further information contact *E&L Instruments, 61 First Street, Derby CT 06418.*

NEW FCC APPROVED REPEATER ANTENNAS

Antenna Specialists Co. has received approval on the following list of antennas from the FCC for use on amateur repeaters under the FCC Docket 18803.

Model ASP-298 – 2M, omnidirectional, 4.5 dBd.

Model ASPB602 – 2M, omnidirectional, 6.0 dBd.

Model ASPB602 – 2M, directional, 9.0 dBd.

Model ASPA680/681 – 2M, omnidirectional, 3.55 dBd.

Model ASP-701 series – 3/4M, omnidirectional, 8.25 dBd.

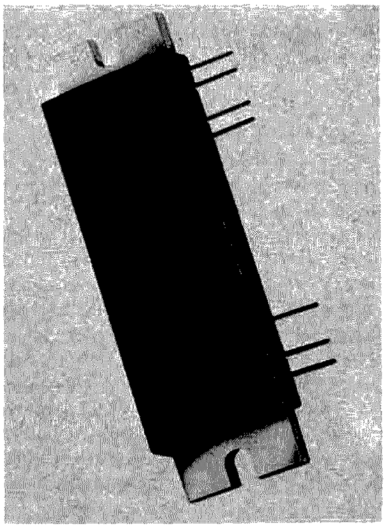
Model HM-191 – 3/4M, omnidirectional, 8.25 dBd.

Model HMR173 – 2M, directional, 13.0 dBd.

Model HM-173 – 2M, directional, 13.0 dBd.

For further information write to *The Antenna Specialists Co., 12435 Euclid Ave., Cleveland OH 44106.*

UHF POWER MODULES

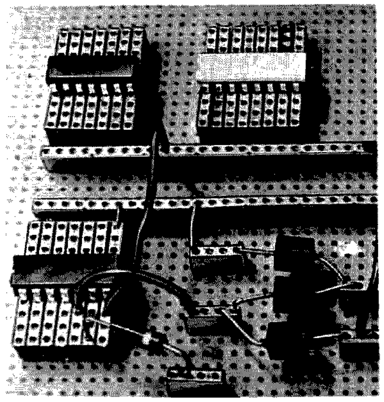


Three integrated UHF hybrid power amplifiers, which deliver 10, 13, and 15 watts respectively at 450 MHz, have been announced by the RCA Solid State Division. The RCA-R47M10, R47M13 and R47M15 are complete solid-state hybrid integrated power amplifiers for use in mobile communications equipment. Each amplifier consists of three cascaded stages interconnected by matching networks that use microstrip lines and thick-film capacitors on alumina substrates. They operate across the frequency range from 440 MHz to 470 MHz, with 20 dB gain, using a power supply of 12.5 volts. They have high efficiency (typically 40%), 50-ohm input and output impedances, and infinite load-VSWR capability. The package is compact, permitting high packing density.

These modules are certainly going to revolutionize the process of assembling UHF power amplifier stages. They completely eliminate the discrete components associated with solid state design and their usual matching problems.

The prices (at the 100 unit level) run from $31.20 to $42.00. For further information contact *RCA Solid State Division, Box 3200, Somerville NJ 08876.*

HI–SPEED BREADBOARD



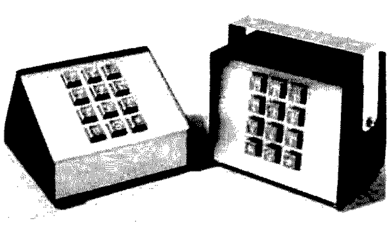
A new breadboard terminal system provides speedy solderless assembly and connection of discrete semiconductors, ICs, pots, switches and other passive devices.

The terminal system, designated Klip-Strip by Vector Electronic Co., consists of connected spring clips assembled in groups of four, called "quads", and in groups of 32 and 48, called "bus strips". All components are accessible and circuits are easily modified. Bus strips of eight and twelve connected queda supply cpmmon signals and power. Components inserted in the quads from either top or bottom are held firmly without solder and interconnected with ordinary jumper wire sizes 20-24 AWG. Larger wire can be plugged into open ends of quads.

Klip-Strips and individual quads are available from stock and priced at $0.09 per quad in packages of 100. Kits containing quads, strips, insertion and extraction tools, and assorted hardware are available at nominal cost.

For more information contact *Vector Electronic Company, 12460 Gladstone Avenue, Sylmar, California 91342. (213) 365-9661.*

ENCODER ENCLOSURES



Finally available are attractive Touch Tone encoder enclosures for base or mobile station use. Your pad is held properly in position by premounted inside brackets. Top and sides are walnut-wood-grain vinyl covered. The satin anodized aluminum face is die punched to accept the standard twelve button dial. (Western Electric, Stromberg-Carlson, ITT-

Kellogg, etc. – but automatic electric dials will not fit because they use non-standard spacing between the buttons.) The mobile mount "M" enclosure has an anodized pivoting gimbal bracket which provides multi-position under instrument panel mounting, as well as top of equipment mounting on four rubber feet. The base station model "B" holds your dial at a convenient 30-degree angle. There is ample room inside both models for transmitter keying circuitry. Either model is $5.50 (donation) plus postage and handling – dial not included. Available from the *Detroit Area Repeater Team, P.O. Box 201, Clawson MI 48017.* Donations are used to maintain and upgrade repeater station equipment and facilities.

450 MHz TRANSVERTER

SBE has just announced the SB-450 TRC, a 450 MHz transverter that lets you gain access to 450 with your 2 meter FM rig. Feeding it with 10 watts of 2m power will get you 4W output on 450 via its varactor tripler. Although it is specifically designed for use with the SBE-144, any 2m rig will work fine as long as the 2m drive never exceeds 12 watts.

Since the transmitting process is straight tripling, your 2m rig will need to have a few extra 450-only crystals installed. This should not be a problem if your rig is a multi-channel unit or if you use a synthesizer. For example, if you wish to transmit on 449.500, a crystal giving you a two meter output of 149.833 will have to be installed. Since this is no longer in the 2 meter band, you might expect a slight drop in output power due to the transmitter's circuitry being peaked to 146-148. Most rigs have sufficiently broad output circuits however, and a small drop in output is not something to worry about in a system that is basically passive to begin with. The transmitting section of the 450 TRC draws no dc power while transmitting.

The receiver section converts via a 300 MHz local oscillator signal to its mixer. This puts the signal in a reasonable portion of the band. If you wish to receive a signal of 444.500, a 2m receive crystal that tunes your rig to 144.500 must be installed. Since you are adding only a front end converter to your 2m rig, it retains all of its characteristics such as selectivity, audio quality, etc. The 450 conversion gain is close to 1.0:1 so as not to inject unnecessary gain into a system that may already be adequate.

If you have been thinking of going 450 but haven't wanted to spend a bundle on a whole new transceiver, the SBE 450 TRC may be worth consideration. For more information contact *Linear Systems, Inc., 220 Airport Blvd., Watsonville CA 95076.*

(W2NSD/1 continued from p.2)

Other than the promise of el cheapo radios, the docket would seem to offer little.

So what does the docket take away from amateur radio? Well, not a lot from the average amateur. Perhaps this is unfortunate, in a way, for if there were some impending doom, the response to the FCC might be a little more heated. The Walker repeater rules have so emasculated the development of FM that the promise of the 220–225 MHz band has been virtually laid to rest anyway. The prospect is a dismal one – if we put up a great big fight to retain our band and keep the CBers at bay, we still have to get into a long hassle with Walker to try and roll back, inch at a time, the devestating recent repeater rules before we can begin to get benefit from the band.

This is what happens when you are a sitting duck with no Washington lobby.

You're as helpless as a young girl trying to cross Central Park at midnight – and you're going to get the business.

The 220–225 MHz band has a lot to offer us if we can get the rules straightened out. Our work here at 73 with the new Clegg 222 MHz repeater has shown us that the band is terrific. We get about the same range as 146 MHz, but the repeaters are much, much simpler since the separation has been established at 1600 kHz instead of only 600 kHz, as on 146. Diplexers are still not vest pocket sized, but they are plenty small enough to pop into a plane or a car for a quickie mobile repeater – and they are a lot less expensive.

If 146 MHz has not been castrated by the new repeater regulations and activity does indeed increase, it won't be long before the 220 band will grow substantially in importance to provide relief for the more congested 2m areas.

One other possible benefit that has been suggested by amateurs to getting the CBers into the top end of the 220 band is that there will be an inevitable leak from the CB end into the ham part of the band. It won't take CBers long to figure out how to make up convincing ham calls and join in our repeater fun with their rigs. It is possible that they may tend to accept ham standards of contact rather than CB, in which case we would have a very difficult time telling real hams from ersatz. It has been further suggested that as long as they act like hams, perhaps few amateurs will really care. It's something to think about.

After you've read through the docket – talked it over on the air and at your club, sit down and write the Commission and file your thoughts with them – with 14 copies – plus one for me (please).

KEEP PLUGGING

Those amateurs who are familiar with the benefits of repeater operation realize that this is the greatest thing yet devised for dealing with emergency situations.

The ideal repeater-emergency setup would permit a repeater to be operated as a local repeater during normal times and then in time of emergency it would be capable of providing 24-hour a day communications over a small area – over a wide area – or even over hundreds or thousands of miles, if needed.

The true emergency system would permit repeaters over a group of areas to be interconnected on command. Most of all, the system would be flexible.

Knowing the above, can we really settle for any less? The above certainly is well within our technical competence, even though not very much like that has been set up as yet.

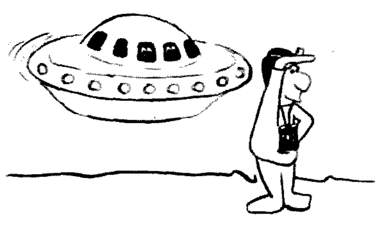
It is a fact that most of the above is absolutely against the law. It is illegal to run a repeater 24 hours a day unless there is an operator right there in control – and obviously no operator would be needed for an emergency. It is illegal to interconnect more than two repeaters even though this limitation would be considered ridiculous for an emergency system. It is illegal to run crossband – and that too would be of immense importance for an emergency system. And so it goes.

Perhaps amateurs should build up these systems for use in emergency, but (since it is illegal) not test them and depend upon waiting for the disaster to work out the inevitable bugs. Walker has admitted that in times of serious emergency that all rules are off – so at that time we could get going on making our system work.

One interim measure that would be both fun and of value would be to set

up an interconnected system of repeaters, but with the limitation that only one repeater could be interconnected to another at a time. In this way we might be able to touch-tone up any of several repeater combinations. The paperwork involved in licensing a system like this would be almost beyond belief! I suspect it would take ten good men ten days to fill out all the Walkerforms required.

THOSE UFOs



A couple of readers have written recently to suggest that some sort of UFO net be set up to help get reports of UFOs to the UFO organizations. Those readers with a long memory will remember when I might have jumped to champion such a scheme. We did support a UFO net for a couple of years – but it didn't come to much.

Now, after a good deal of thinking and puzzling over the phenomenon, I think I have a pretty good idea of what the UFOs are all about – where they come from – why they are here – what they are doing – and why we haven't been able to get hard facts about them.

I think the light began to really dawn for me when I read an article a couple of years ago in the British magazine *Flying Saucer Review*. They had a very good article showing photographs of cave paintings that had the most commonly observed type of UFO depicted, complete with "space men." These paintings had been made between 20,000 and 30,000 years ago and covered a period of about that sweep.

Perhaps I should admit that about the time that I read my 500th detailed story about a sighting of these contraptions I gave up any idea that they did not really exist. This was helped by talks with good friends of years who had seen them up fairly close. Okay, so there is something – why are the UFOs so hard to pin down? Gradually it dawned on me that this was a factor that should fit into the whole picture – for some reason the UFOs have remained ephemeral and are continuing to remain such. And every time someone gets anything approaching hard evidence something odd happens to it. Hmmm.

Now what kind of a civilization could be inventive enough to think up and build a UFO – and then not change the model for over 30,000 years? That's patently absurd, of course. And how do we explain so many different types being spotted in the last few years? It all must fit together some way.

The obvious answer is that some time in the future – perhaps around 5688 A.D., they invented a way to travel through time and applied this to their then current saucer model Chevrolet. Quite a few historians came zipping back through the years to get data and bring the history books up to date – hence saucers being reported from so far back – in the diaries of Alexander – and off and on since then.

This might explain why the people who come back in them resemble us so much – yet are a bit different – some being a bit smaller – some a bit larger. Most of them seem to have helmets – perhaps around the year 2000 the carbon monoxide from car exhaust got so pervasive that people adapted to it and when they come back they can't manage on our "pure" air. Whatever.

We don't have any experience with the laws of time travel so we don't know just what will happen when a man goes back and kills his grandfather – but it would seem to be a bad scene and I expect that these rules will be worked out by trial and error by those first travelers in their saucers. If they louse things up enough to change the future it might be that they would have to come back again and fix their boo-boo. It is fun to speculate about it.

For this reason I am reasonably sure that the UFOs are going to remain elusive and it follows that any attempts at trying to catch them via amateur radio will be exercises in futility. They don't dare be really caught – and if anyone does, the UFOs will have to go back again and uncatch themselves.

I hope I haven't been a party-pooper for UFO enthusiasts. And I hope that anyone who has any reservations whatever about the reality of UFOs will get out there and read some of the UFO books – perhaps join one of the UFO organizations and get their newsletters – subscribe to UFO magazines. UFOs, like many other things in this world, become more real when you know more about them. You'll find very few wild-eyed believers or kooks involved with serious investigation of the UFOs – and you will find few who doubt their existence.

The more you read about UFOs, the more I think you'll find that my theory provides answers for all of the observed phenomena.

Some of the rarely seen UFOs are probably from even more remote times and since history has already been completely rewritten, they are probably back on some specific research projects.

HAM NEWSPAPERS

The other day some amateurs were telling me how profitable a ham-trade type newspaper was. I tried to explain that this type of publication looks like a winner – and it looks good enough so many have tried it – but the fact is that for some reason amateurs don't support them and they die when the bankroll dries up.

The recent demise of Radio Trade-Around out of Findlay, Ohio, is a case in point. This paper had a circulation of about 125,000 – and that certainly is impressive. But the actual paid circulation is reported by West Park Radiops (Cleveland) to have been about 3000.

Last year we saw the Ham Trader expire of similar causes – and back through history there have been countless others. Swap and Shop ran for several years before the money-bags shriveled up.

Apparently there is room for specialized newsletters which are put out as a hobby. I got started via that route with a radio Teletype bulletin way back in 1951! I ran that publication for four years, footing most of the bills myself and working up to a magnificent paid circulation of about 3000. The FM Journal, after several years of work, got up around that level too in the FM field. That was nowhere near enough to stay in business without a rich daddy – so it folded. Ditto RPT – and how many others?

It would seem that amateurs should make more of an effort to help new publications survive if they want to have them around. The subscription fees are not usually a hardship – and the more publications we have the better amateur radio will be. Is it really fair to have fun with amateur radio and not put something back into it in the way of support for publications? 73 will welcome comments, pro and con.

MIDCARS BAD GUY

After being asked to come to the Midcars meeting at Dayton to give a little pep talk to the group, I was virtually thrown out of the meeting by Midcars Czar K4DLA. He said flatly that he had no intention of permitting me to speak, even for a single minute.

Having run into this type of person at a few ARRL conventions, I was not

(W2NSD/1 continued on p.94)

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MONO - BAND LOG - PERIODIC ANTENNAS PART I

For the past three years I have been testing Log-Periodic fixed beam antennas at this QTH. They have given excellent results – however they do require considerable acreage. This article describes smaller single band Log-Periodics which require less space than multi-band types but still retain the good forward gain, directivity, and the swr remains relatively flat across the entire band for which they are designed. They are easy to construct, are quite inexpensive and require no tuning or complicated impedance adjustments.

The original L-Ps used here were for multi-band operation on 20, 15 and 10, having 12 to 17 elements. This single antenna operates about equally well on each of the three bands. The measured gain was from 8 to 13 dB depending on their size (boom length), number of elements and its apex angle.

Figure 1 illustrates a typical Log Periodic covering the frequency range 14 to 30 MHz for operation on 20, 15 and 10. Most of these used here for different directions are 12 to 30 meters in length (boom length). They are mounted 12 to 15 meters above ground. The material cost is quite reasonable because of the wire construction, generally running from $12 to $25 each.

I have since designed and tested other Log-Periodics for 40, 20 and 15; 15, 10 and 6; 20 and 15 only; and more recently mono-band L-Ps for 40, 20, 15 and 10 which will be described. To date I have assembled and tested many of these for various frequency ranges and for various directions. All have been of the horizontal doublet type Log Periodic (DLP) configuration with the exception of one vertical mono-pole Log-P for 80, using radials for the ground plane or counterpoise.

Since over-the-air testing of the original Log Periodics generated considerable interest, many inquiries were received during QSOs and also by mail and phone calls inquiring if single or mono-band L-Ps are practical to reduce overall length for those primarily interested in single band operation. The answer is yes, and a mono-band L-P will still retain a gain of 8 to 10 dB in the forward direction (compared with a ½λ horizontal doublet at the same height), and the swr is relatively flat across the band.

Number of Elements Required

At least 12 elements must be used for a Log Periodic having a 2 to 1 bandwidth or one octave frequency spread, i.e., for operation on any frequency between 40 through 20; 20 through 10, etc. An L-P for a single band or a limited frequency range requires only 5 to 6 elements. I have even had good results using only 4 elements to cover the complete 20m band, 14.0–14.35 MHz. However there is an advantage from using an odd number of elements from a mechanical

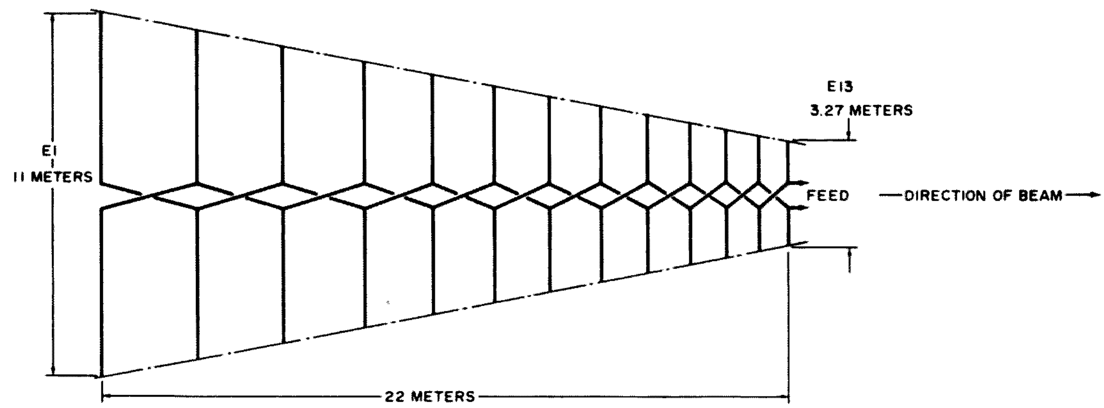

Fig. 1. Typical 2:1 bandwidth log periodic antenna, 14 to 30 MHz, for 10, 15 and 30 meters. $\alpha = 11^\circ$.

standpoint, as will be explained later. Therefore these L-Ps for mono-band operation all use five elements, as illustrated by Fig. 2.

Since high pine and cedar trees are used as "masts" to suspend the various antennas, the height above ground has generally been limited to 12 to 15 meters. Due to the arrangement of the trees, it was not practical to try a horizontal double type (DLP) on 80 as the height would have been limited to 12 meters, which is insufficient to realize full gain. For operation on 80 the vertical mono-pole L-P configuration mentioned above was tried. Since only ¼λ vertical radiators are used for this antenna, less height was required. Further, the vertical type gives a lower angle of radiation, better suited for longer haul circuits. This antenna is not described here; however the data on bandwidth, etc., obtained from the 80m test was sufficient to provide information to give the various dimensions for the horizontal DLP configuration for 80, should anyone have the space and support height (at least 19 meters) to use one to advantage. The listed swr readings for 80 were from the mono-pole type, but should be about the same for the doublet L-P.

All of the other mono-band Log Periodics for the higher bands were tested at a height of 12 to 15 meters above ground and a recommended minimum height is given for each band in the Table.

Theory of Operation

The theory and design of Log-Periodic antennas is rather complex. As this information and the design formulas have been presented in several amateur publications, it will not be repeated here. The best article on design formulas was "The Design of Log Periodic Antennas" by A. E. Blick VE3AHV, in the May 1965 issue of *73 Magazine*. Although this primarily covered VHF L-Ps for the 50–54 MHz band, the formulas hold for HF as well. The dimen-

sions of the Log-Periodic antenna are such that the electrical properties repeat with the logarithm of the frequencies.

In effect, these antennas are a broad band unidirectional end-fire array. For those more acquainted with the yagi, you might consider the five element mono-band L-P illustrated by Fig. 2 as having a ½λ driven element (#2), a longer driven reflector (rear element #1) and three shorter driven directors, elements #3, 4 and 5. These are fed by a two-wire open center feed line which is in turn fed at the forward or short element end as shown.

It will be noted that transposition takes place between adjacent elements. Further for a single band it is possible to space the elements so that the main element, #2, is approximately ¼λ from the shortest forward element, #5. This simplifies the method of feed or impedance match at the feed point as will be explained later.

From the formulas given by K4GYO in his article on L-Ps in the October 1967 issue of *73 Magazine*, it is noted that the design of Log-Periodics is not simple. As all dimensions for element lengths and element spacings are given by this article, no math is required if these dimensions are followed.

Feed Method

The easiest method of feeding the mono-band Log-P is by means of a 4:1 balun with the high impedance balanced input connected directly to the center open wire feeder at the short element or input end, then to coax to the shack. The latter can be any required length.

It was found that the impedance at the center of the ½λ element #2 is in the order of 30 to 33Ω as measured with an Omega Antenna Noise Bridge. The ¼λ open center feeder between element #2 and the short element feed point acts as an impedance transformer with the feed point being in the order of 200 to 300 Ω which is easily matched by the balanced input of the 4:1 balun, and in turn to the coax. On 40 the swr across the band measures as follows:

7.0 MHz	–	1.05:1
7.1 MHz	–	1.05:1
7.2 MHz	–	1.01:1
7.3 MHz	–	1.1 :1

The swr for the 10, 15 and 20 meter equivalent mono-band L-Ps are similar to those on 40.

Although an 80m mono-band DLP has not been tried, the equivalent mono-pole configuration mentioned above gave the following swr readings:

3.5 MHz	–	1.2:1
3.6 MHz	–	1.2:1
3.7 MHz	–	1.1:1
3.8 MHz	–	1.2:1
3.9 MHz	–	1.4:1
4.0 MHz	–	1.25:1

This will illustrate the broad-band nature of the Log-Periodic (even for a single band type) which is an excellent feature of this type antenna.

Another simple method of feeding a mono-band L-P is by a tuned feeder from the shack end to the input of the L-P. This eliminates the expense of the 4:1 balun. However, a "match box" or other tuner is required between the set and the tuned line. For a multi-band L-P, the 4:1 balun is simpler as the tuner requires retuning when shifting bands, making it necessary to adjust two or three additional controls. This is not objectionable for single band operation, but is a nuisance if you shift bands frequently. If not already on hand, the tuning unit will probably cost as much if not more than a 4:1 balun.

Test Results

Most of the testing on the mono-band Log-Periodic here has been on 20 and 40. Both give a very consistent 10 dB gain in the forward direction. The one for 20, beamed at 150 degrees, was used for several months, keeping test schedules at noon several times a week with my friend YV5DLT in Caracas. Most of the original 20-15-10m L-Ps had also been thoroughly tested with this station. He has been of great assistance in giving very accurate evaluations of these antennas. During the years we nave been testing these, I have kept the same non-gain antennas used as "standards," for comparison with the L-Ps. By this procedure we have been able to obtain very accurate comparisons.

Most of the testing on the 15m L-P was also conducted with YV5DLT and other South American stations with similar results to those on 20.

One of the 40m mono-beam L-Ps is beamed south, and almost daily tests have been made with my friends W4QS and K4FBU in Florida over the past year. I use a good 40m doublet as the "standard" which is at the same height as the 40m L-P. A coax switch allows instant switching between these antennas. The doublet is horizontal (not an inverted V) and is in the clear. It

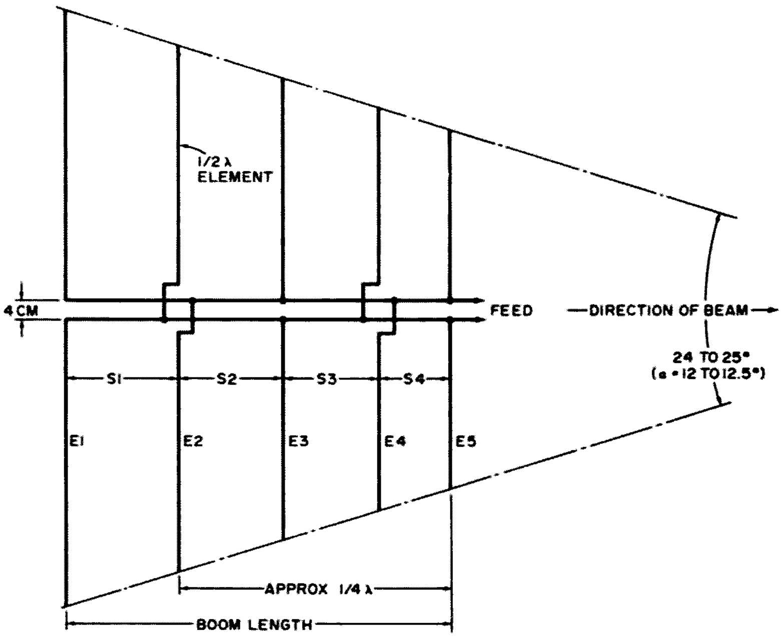

Fig. 2. W4AEO mono-band 5-element log periodic.

Table I

Band MHz	28.0–29.7	21.0–21.45	14.0–14.35	7.0–7.3	3.8–4.0	3.5–40	Notes
E-1	5.33	7.10	10.67	21.34	39.62	42.67	
E-2	5.10	6.86	10.06	20.12	37.79	40.84	
E-3	4.27	5.67	8.53	17.07	33.83	35.36	
E-4	3.73	4.97	7.47	14.93	27.43	30.48	
E-5	3.20	4.42	6.25	12.95	23.77	23.77	
S-1	1.07	1.43	2.13	4.27	7.92	9.14	
S-2	0.99	1.31	1.98	3.96	7.32	8.23	
S-3	0.92	1.22	1.83	3.66	7.01	7.32	
S-4	0.76	1.00	1.52	3.05	5.49	5.79	
Boom Length	3.73	4.97	7.47	14.94	27.74	30.48	
S2 +3 +4=	2.67	3.54	5.34	10.67	19.81	21.34	
Wire needed (Elements)	26.5	34	48	92	167	178	Note 1
Wire needed (Center feeder)	9	11.5	16.5	31	57	63	Note 1
Total wire	35.5	45.5	64.5	123	224	241	
Min. Ant. hgt.	10.6	12	12	12–15	20	21	Note 2
Opt. hgt.	21	21	21	43	40	43	Note 3

Note 1. These measurements include extra length for connections, etc.
Note 2. Telescoping TV masts suggested for higher bands.
Note 3. A height of 2 ½λ better for multi-hop paths.

All measurements are expressed in meters.

should be as efficient as most doublets. When my friends receive me S-8 to 9 on the doublet, they invariably report at least a 10 dB increase on the L-P; and often "20 over 9." These are consistent day-after-day reports. The "S" meter at this end also confirms this increase in received signal in the forward direction.

Three of the 10m L-Ps aimed in different directions have been used here for monitoring the AMSAT Oscar 6 satellite 10m downlink. These were compared with a 10m vertical ground plane about 10 meters above ground. It was found that when the satellite comes over the horizon in the beam width of one of the L-Ps, acquisition could be had about 5 minutes earlier on the L-P than on the vertical. As Oscar 6 approached an overhead or near overhead pass, the vertical is better. Then as it passed over, the L-P in the other direction could copy it a few minutes longer than on the vertical.

I wish to point out that the beam width of the L-Ps tested here are usually wider than a yagi, being about 100 degrees in width. This is good for a fixed beam which may be beamed for a certain part of the country or for those interested in DX from a certain continent.

On 20 my northeast Log-P seems to cover Europe quite well. The 150 degree beam covers Caracas and the east coast of South America. The south beam, South and Central America, and the west beam W6s, Australia and others to the west.

I can certainly recommend the Log Periodic for anyone having the space. From the dimensions in the table it can be seen that mono-band L-Ps for 10, 15 or 20 are entirely practical. Considering the gain possible for the moderate expense involved, it is felt that hams have been overlooking a good bet by not making more use of these very excellent antennas. 10 dB gain in a desired direction for $15 to $35 is not bad compared with the price of a linear having the same gain. This gain is also quite evident on the received signal. Further, it seems to have a diversity effect on receive when QSB is bad. As 3 to 5 dB is generally considered a fair antenna gain on 40 (2 extended ½λ in phase or a two element yagi) the 10 dB possible from a mono-band L-P is certainly worth considering.

Next month the step-by-step construction of a mono-band L-P will be presented along with mounting and testing details.

. . .W4AEO

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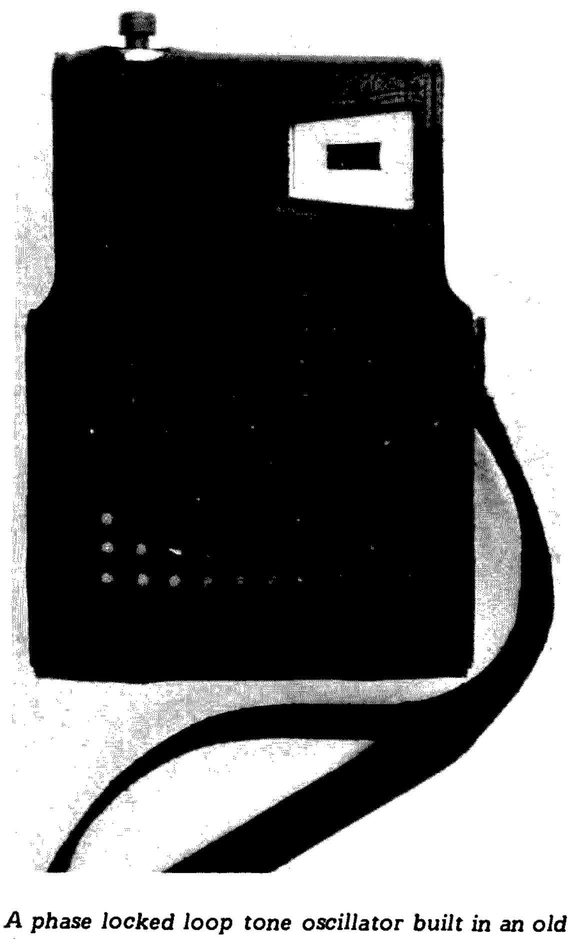
AN ACOUSTICALLY COUPLED DIGITAL KEYED SQUEAKER FOR TONE BURST ENTRY

or,
Who knocked the phase for a loop in the rice box radio?



A phase locked loop tone oscillator built in an old 6 transistor radio. The only external difference is the lack of a tuning capacitor and an added pushbutton.

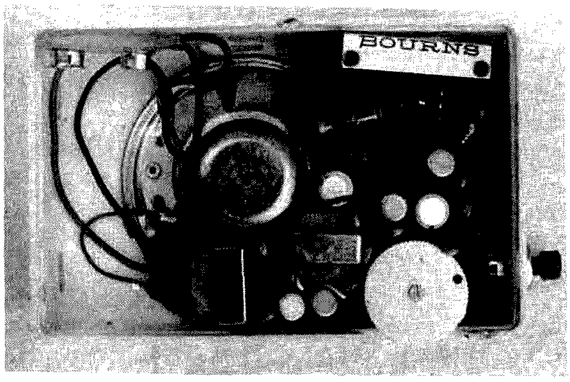
If you immediately understand $f_o \sim 2(V+ - V_c)/R_1C_1V+$; if you completely understand the theory of phase locked loops, and if you are not at all interested in a cheap and easy method of tone production for repeater entry, code practice, etc., then turn the page. This article is especially for people who want some easy fun putting an up-to-the-minute solid state device to practical use. The result is a stable, accurate, tone generator at a very low price.

The NE566 is called a Phase Locked Loop Function Generator. The phase locked loop has been explained in previous issues of 73. Near as I can figure, the function generator part means it's some kind of fancy oscillator. If you turn to the back of the magazine you will probably find them available for less than $5.00. If you order one you'll find that it's a lot smaller than a folded five dollar bill. Only seven other parts and any old transistor radio you might have in the junk box are needed. The 5 KΩ variable resistor can be any kind of miniature variable, but a ten turn trim pot allows easier setting of the tone. You'll also need some ferrite beads. These are inexpensive and can be ordered when you order the phase locked loop. No other exotic or difficult parts are needed.

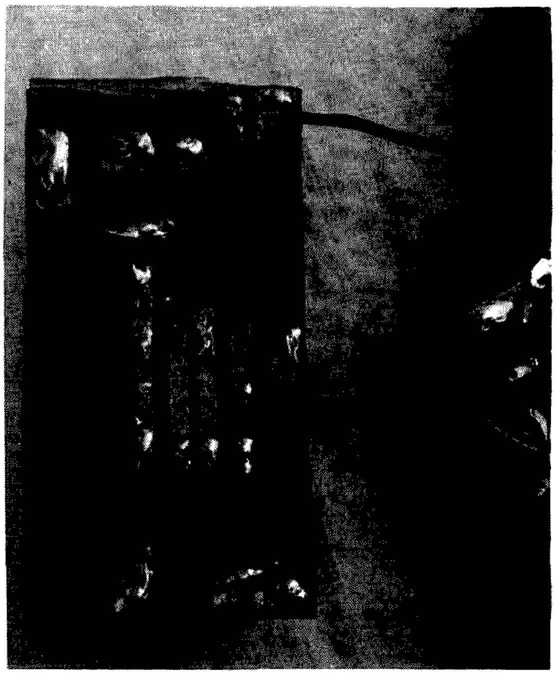
I tried several oscillator circuits in an attempt to build a tone encoder for use on tone entry two meter repeaters. I ran into problems with impedance matching, rf stopping the oscillators, rf feedback, proper keying, etc. Also, I would have had to build several oscillators for all of my rigs including

A touch tone can also be used with a borrowed radio audio section. This unit does double duty with both a touch tone and PLL oscillator feeding through the same audio unit. Pushing the buttons is the author's wife, WA7NDK.

the portables. My solution was to use one atmosphere density acoustic coupling with an integrated humanoid digit for keying. In other words, I took all of the rf parts out of an old cheap six transistor Far East radio, poured the little oscillator in with the remaining audio circuit, put the microphone in front of the speaker, and keyed it all on and off with a pushbutton. The unit fits in my shirt pocket and I can use it with any rig I happen to be near. The six transistor AM radio is usually found in a drawer in almost everyone's house. It's the one you got for depositing $500 in a savings account or getting a red star on a cash register receipt. Maybe you bought it for the beach. Usually you find the battery has gone flat and often the rf sections have gone weak too. The audio sections, however, are almost always still good. They typically use a one transistor audio driver transformer coupled to two output transistors. Removing the rf portions of the circuit is easy. To prepare for this brain surgery first remove the radio circuit board from the case. Identify the volume control and tuning capacitor. Look for a wire running from the volume control over to the i-f part of the receiver. Make note of it because it carries your tone into the amplifier part of the circuit. Clip it where it connects with the i-f. Find a line halfway between the tuning capacitor and volume control from the top of the board to where it meets the speaker. Cut the board in half at this point. Put the rf part of the board and the antenna coil in the junk box. (Don't throw it away – it might conceivably have a use sometime in the next thousand years.)



The oscillator board is on the left. The remaining audio portion of the radio on the right. The three ferrite beads are on the plus lead to the oscillator. The audio output lead is the high quality connection on the top.



This home brew circuit board has a simple layout you may wish to copy. (Board by WA9FCG) The IC goes cross wise in the lower center. The resistors and cacpacitors go from island to island to make the proper connections.

When you cut the board in half, you broke a circuit that runs all the way around the outside of the board. Take a small piece of wire and re-connect the foil at the extreme edges where you cut it. Connect the very top foil line with the very bottom one along the cut. At this point you should be able to connect a fresh battery and hear a click in the speaker when you turn on the volume control. Hold on to the metal part of a screwdriver and tickle the wire coming from the volume control. If you don't hear any pops or sounds even when you click the switch, try and figure out what you did wrong and get the next radio. These six transistor radios are all remarkably similar on the inside, regardless of the case or brand name.

The parts of the oscillator can be mounted in any way. I used a board that WA9FCG had made at home. You can make your own, use perfboard, or put it on a small rectangle of shirt cardboard. Keep the leads short so that rf doesn't have a chance to sneak in. A piece of wet tissue on the pin near the body of the IC should keep it healthy if you solder directly to it.

Back at the radio, unsolder the battery lead that goes to the volume control switch. Find an open place and stick a small momentary contact push button switch in the radio case. Connect the battery lead to this switch and back out to the radio and oscillator. (Watch polarity! If they had the negative lead going to the switch then be sure and connect it to the oscillator ground side.) Slip three ferrite beads over the positive battery lead close to the oscillator. This keeps it from changing tone when you

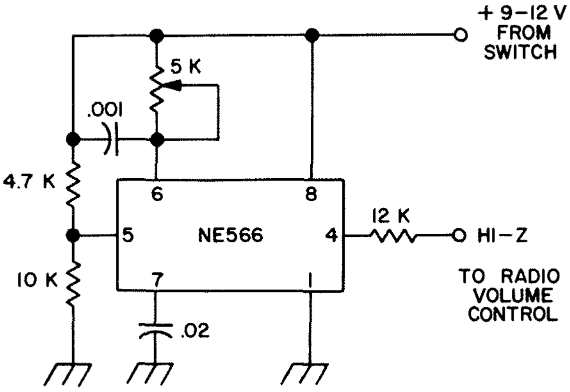


Fig. 1. Schematic of the tone generator.

WA7NDK/1 squeaking into the W1QXR repeater. One tone burst unit can be used with every rig.

have it right next to the antenna. Connect the audio lead coming from the volume control to the output of the oscillator. Run a wire from the negative battery lead to the ground side of the oscillator. (Unless you have already connected the negative as above.) Set the tone control to mid range, turn the volume control on high, hook on a battery, and you should have a nice tone when you push the button. Another advantage of this system is that the tone can be set just by listening to somebody else's tone and using your perfect pitch to match them up.

The NE566 is rated for 12 volts, but they all seem to play fine on 9. Battery life is reasonable because of the limited time. Beware of some of the cheap momentary contact switches you can buy. Some of them make such poor contact that they throw in a different resistance every time you press them.

The technique of borrowing the audio section out of a little radio has also been used with a touch tone pad. This makes a nice portable unit with no connections needed. Chop up a radio and let yourself go.

. . .K9KIC

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Thomas P. Litty, President
TPL Communications, Inc.
13125 Yukon Avenue
Hawthorne CA 90250

THEORY AND DESIGN OF VHF & UHF AMPLIFIERS UTILIZING RF POWER TRANSISTORS

Almost all rf power transistors in general use today are of the balanced emitter silicon planer type. In essence this means the transistor is constructed of silicon material utilizing a planer process with all emitters stabilized by resistors.

NPN and PNP transistors are both available for use as rf power amplifiers. This is largely due to the fact that Motorola C & E, the largest user of rf transistors in the world, designed their high band VHF Micro Radio with the PNP variety. If it were not for Motorola, therefore, there would be no need for PNP transistors, since they offer no advantage over the NPN and in fact are slightly more difficult to build and use.

The NPN transistor is built using a doped silicon wafer. The wafer is doped to form a high conductivity layer, now as an epitaxial layer, on one side, and a Si O_2 glass layer on the opposite (see Fig. 1).

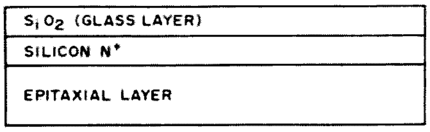


Fig. 1. Silicon wafer, side view.

Using a photographic process, the Si O_2 layer is imprinted with a base mask. This mask is actually a photograph of the base region of the transistor (see Fig. 2).

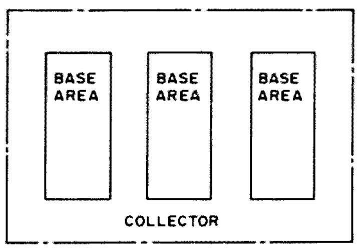


Fig. 2. Top view of base area mask for a single transistor.

This base area is then etched out of the Si O_2 using hydrofluoric acid. A Boron gas is then passed over the open areas. The Boron gas dopes the open area positive (since this is a NPN transistor) and forms a positive base region (see Fig. 3).

It might be well to mention at this point that a single silicon wafer (2–5 cm diameter)

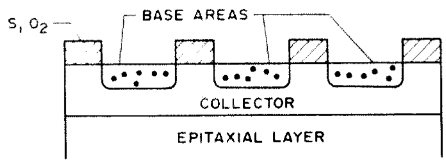


Fig. 3. Side view of a single transistor, showing base diffusion.

usually contains hundreds, if not thousands, of individual transistors.

The holes cut for the base area diffusion are then filled up by ethyl silicate, a substance similar to Si O_2, and new holes cut for the emitter regions by the same process as that used for the base.

The emitters can then be diffused through these holes using a gas containing phosphor (see Figs. 4 and 5).

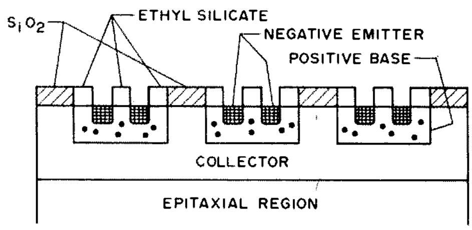


Fig. 4. Side view of a single transistor, after emitter diffusion.

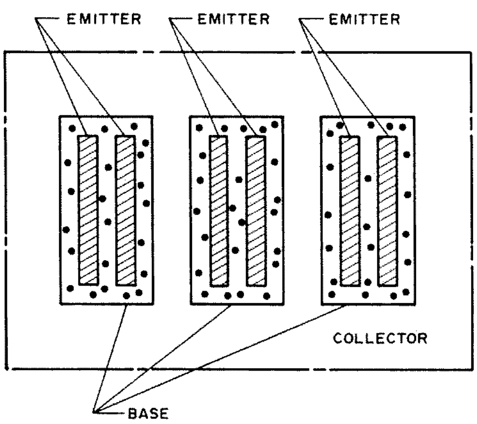


Fig. 5. Top view of collector emitter and base areas of a single three cell transistor on a silicon wafer.

A very important question should now have entered your mind. How do we connect all of the base and emitter areas together and to the outside world, so we can do something with the transistor besides look at it?

The connections are made by an aluminum metalization surface which is deposited and then etched to form contacts between all emitter and all base areas. Gold is being used in place of aluminum by some manufacturers because of its ability to extend the transistor life during high temperatures.

It is at this time that the emitter balancing resistors – among the more common are nichrome and aluminum – are deposited (see Fig. 6).

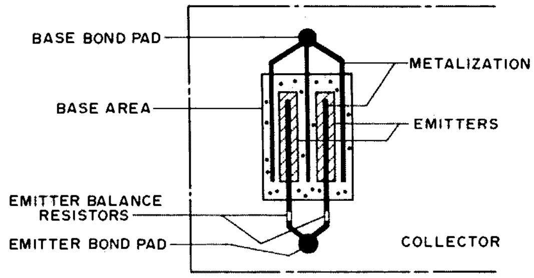


Fig. 6. Top view of one cell of a transistor with metalization and emitter resistors.

When the wafer has reached this point it is diced up, forming thousands of individual chips identical to the one I have been describing.

Connections to the outside world are now made by fine gold wires connected from the base and emitter bond areas to the respective transistor package terminals.

Collector contact is made through the bottom of the transistor chip which mounts to a metalized beryllium oxide wafer (see Fig. 7).

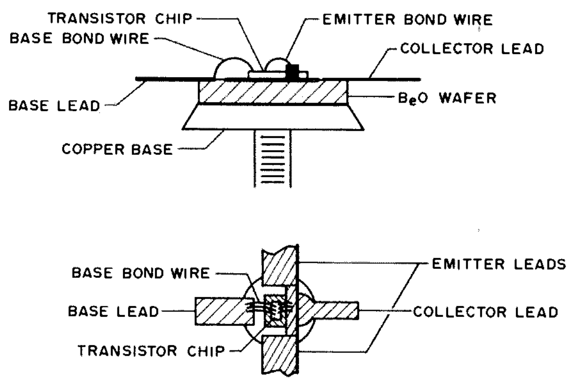


Fig. 7. Transistor

VHF and UHF

At VHF and UHF a transistor no longer looks exactly like a transistor. Figure 8 depicts the equivalent circuit.

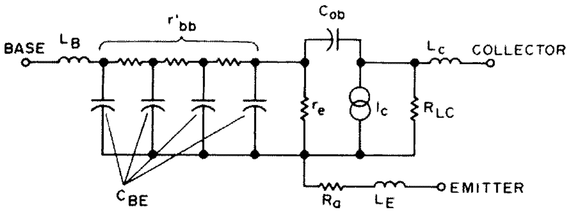


Fig. 8.

Once we understand what the transistor looks like, it is possible to design a circuit that will give optimum performance.

Circuit Design

As we have seen from the equivalent circuit of Fig. 8, the transistor at VHF and UHF cannot be viewed simply as a current amplifier since it possesses too many reactive components to make life that simple. The solution therefore must be to impedance match the rf power (rf current if you wish) in and out of the transistor. To do this with the minimum of effort, we may simplify our equivalent circuit to the extent shown in Fig. 9.

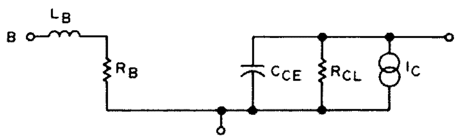


Fig. 9.

I will also make another assumption, and that is that all system work done with these amplifiers will be 50Ω.

Base Matching

To match the base of the transistor to 50Ω, it is often advisable to resonate out the base inductance L_B at the operating frequency or its second harmonic. For simplicity we will resonate it at the operating frequency as follows:

1. Obtain the parallel equivalent circuit for L_B and R_B:

$$Q = \frac{X_{LB}}{R_B}$$

$$R_{BP} = (1 + Q^Z)\, R_B$$

$$X_{LBP} = \frac{(1 + Q^2)\,(j\, X_{LB})}{Q^2}$$

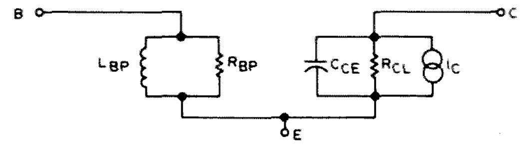


Fig. 10. New equivalent circuit.

2. By selecting a capacitor with a value – jX_{LBP} – we can resonate out the base inductance. The capacitor is placed as shown in Fig. 11a.

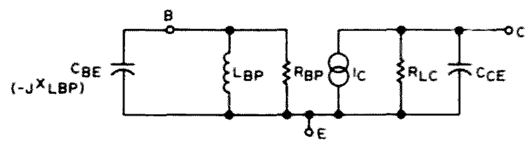


Fig. 11a.

With C_B now in place our circuit looks as depicted in Fig. 11b.

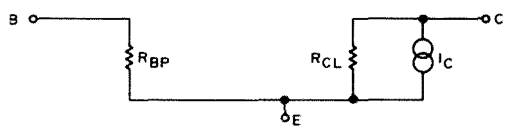


Fig. 11b.

3. We now may match the input impedance to 50Ω by using the simple impedance matching network shown in Fig. 11c.

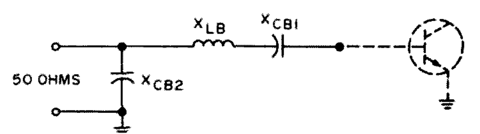


Fig. 11c.

X_{CBI} is simply a Q multiplying capacitor which also allows adjustment to the circuit should any be necessary.

The values of the components can be computed as follows:

$$Q = \sqrt{\frac{50}{R_{BP}} - 1}$$

(Use this number for solving equations below.)

$$X'_{LB} = Q\,(50)$$

$$X_{CB1} = .5\,(X'_{LB})$$

$$X_{CB2} = X_{LBP} = \frac{(Q(50))\,(1+Q^2)}{Q^2}$$

Collector Matching

To match the collector output to 50Ω we proceed as follows:

1. Determine collector load impedance as per this formula:

$$R_{c}l = \frac{V_{cc}^2}{2\,Po}$$

2. By using the following simple circuit (see Fig. 12), we may match the collector load impedance, R_{cI}, to 50Ω. This assumes you are developing enough power to make R_{cI} less than 50Ω., i.e. appx. 1.4W @ 12V. If this is not the case, other simple variations of this circuit can be used, for example, reverse it.

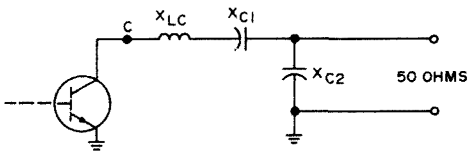


Fig. 12.

Calculations for X_{LC}, X_{CI}, and X_{C2}.

$$R_{CL} = \frac{V_{cc}^2}{2\,Po}$$

$$Q = \frac{50}{R_{CL}} - 1$$

$$X'_{LC} = Q\,R_{CL}$$

$$X_{LC} = 1.4\,(X'_{LC})$$

$$X_{CI} = .4\,(X'_{LC})$$

$$X_{C2} = \frac{(1+Q^2)\,(X'_{LC})}{Q^2}$$

The only step left is to provide dc voltage for the amplifier. This is done through a dc isolation choke of approximately five times the collector load impedance. Some base to ground dc connection should also be provided to eliminate high standby leakage currents and to prevent the rf input power from biasing the transistor off (loss of power gain will result). See Fig. 13.

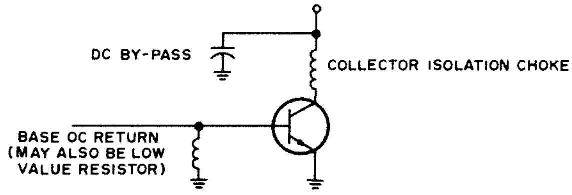


Fig. 13.

The collector choke should be heavily bypassed, on the dc side, to eliminate oscillations and rf feed-through into the rest of the system.

Practical VHF and UHF Amplifiers

I am going to describe several simple designs that will make any VHF or UHF transistor play quite well and explain how you can optimize them for best performance.

This amplifier will work with any VHF transistor whose power output is between 3 and 40W.

Some of the more common transistors that can be used and their respective power gains are listed in the table.

Power Output	Power Gain	(Mfr.)	Type
3–5W	10 dB	TRW	2N5589
		TRW	PT5589
		SSS	2N6080
		CTC	B-2-12
7–12W	6–8 dB	TRW	2N5590
		SSS	2N6081
		CTC	B-12-12
10–18W	8–10 dB	SSS	2N6081
		TRW	PT5649
		CTC	B-12-12
20–30W	5–8 dB	SSS	2N6083
		TRW	2N5591
		SSS	2N6082
30–40W	4–7 dB	SSS	2N6084
		TRW	2N5706
		CTC	B-40-12

Referring now to Fig. 14, these transistors will work quite well with the suggested values and if you follow my tweaking

(cut-and-try) suggestions, will result in an exceptionally well-performing amplifier.

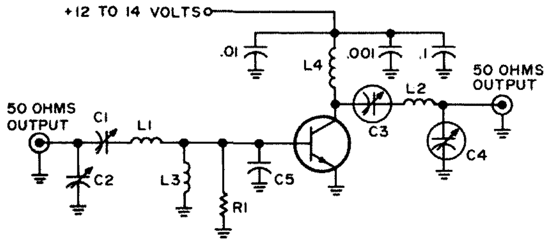


Fig. 14. Frequency range, 140–175 MHz.

C1, C2, C3, C4 – ARCO 404
C5 – 100–150 pF
L1, L2 – 3T #16 0.7 cm I.D.
L3 – 3.3 μH rf choke (appx.)
L4 – 5T #18 0.7 cm I.D.
R1 – 10–500Ω

To tune this amplifier, apply voltage and tune C1 and C2 for minimum reflected power, then adjust C3 and C4 for maximum power output. To tweak this amplifier simply adjust L1 and L2 until C1 and C3 are almost completely meshed for maximum power output and minimum reflected power. Adjust R1 until the output power drops about 5–10% and you are ready to go.

A simple explanation of why we tweak in this way now follows: a) C1 and C3 are made as large as possible to bring the loaded Q down, thus increasing the bandwidth and stability of the amplifier. b) R1 acts as a stabilizing element, swamping and terminating the input circuit so that mis-adjustment will not cause oscillations.

Important Construction Techniques

The following are some very important suggestions that can make or break you as an amplifier builder. If you follow these suggestions in building the latter described amplifier, you should have little difficulty in making it work.

1. Keep the leads as short as possible on all dc bypass capacitors.
2. Keep the leads as short as possible on C5 and place it as close to the transistor base lead as possible.
3. Keep as much ground return area as possible, preferably by using double sided board.
4. Keep the emitter leads on the transistor as short as possible.
5. Follow my suggested circuit layout for maximum success.

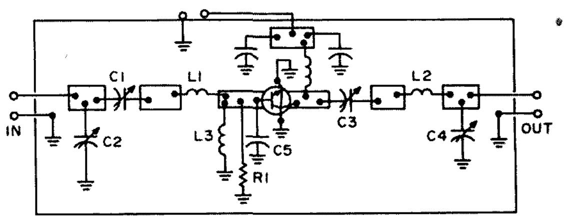


Fig. 15. Suggested circuit layout.

6. Thin copper coil should be used to connect the top ground plane to the bottom ground plane around the emitters, dc bypass and rf input and output.

How to Get More Power and More Power Gain

Now that we have mastered the single stage amplifier the next step is to combine these amplifiers to provide more power gain and/or more power handling capability. Figure 16 is a suggestion of how to cascade and parallel these simple amplifiers to provide 80W of rf power output from 3/10W power input. A handy widget, known as the Wilkenson Combiner, is used to split and combine power. This device utilizes the simple quarter wave transmission line formula for its operation.

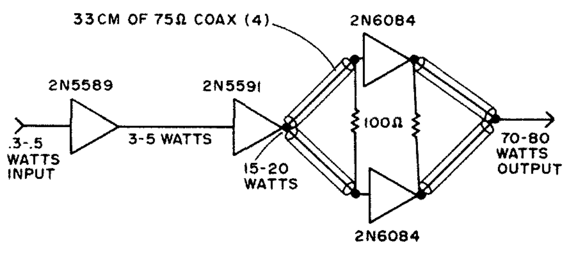


Fig. 16.

Good heat sinking should be provided and the power transistors not stressed mechanically in any way, since they are brittle and once broken, are useless.

The rest is up to you. Packing and utilization of these simple circuits is limited only by your imagination. Remember, the simpler, the better.

. . .K6RAD

220-GOING... GOING... GOING...

Before the
Federal Communications Commission
Washington, D.C. 20554

FCC 73-600
97345

Docket No. 19759, RM-1633, RM-1656, RM-1747, RM-1761, RM-1793, RM-1841.

In the Matter of The creation of a new class of Citizens Radio Service and the reallocation of frequencies between 224 MHz and 225 MHz in the band 220–225 MHz now allocated for shared use by stations in the Amateur Radio Service and Government Radiolocation Stations for that purpose.

Notice of Inquiry
and Notice of
Proposed Rule Making

Adopted: June 6, 1973 – Released: June 12, 1973.

By the Commission: Commissioners Johnson and Reid concurring in the result.

1. Notice is hereby given in the above captioned matter.

2. The following petitions have been received which are applicable to this matter:

a. RM-1633 (Wayne Green petition) filed May 25, 1970 – Proposes to make part of the 220 MHz amateur band available for "Hobby Class" amateurs and to limit 27 MHz Citizens Band operations to "business and personal business" use.

b. RM-1656 (Reed Electronics School petition) filed June 24, 1970 – Proposes to move Citizens Band from 27 MHz to the 220 MHz amateur band and to return 27 MHz frequencies to U.S. Government.

c. RM-1747 (EIA petition) filed February 5, 1971 – Proposes a new "Class E" Citizens Band service between 220 and 222 MHz; 80 channels; 25 kHz channels; 100 watts maximum power. Would not alter Rules for 27 MHz Citizens Band.

d. RM-1761 (F.C. Hervey petition) received February 26, 1971 – Proposes to shut down 27 MHz Class D Citizens Band as now provided in "Parts 95 and 15" temporarily and reassign frequencies "to those Mobile Radio Services in greatest need;" and to create a new "Hobby/Personal Radio Service" in parts of the 220–225 MHz band as a substitute for present Class D Citizens Band.

e. RM-1793 (George Jacobs and Stewart Meyer petition) filed May 10, 1971 – Proposes to establish a new "VHF Radiotelephone License" in the Amateur Radio Service anywhere above 144 MHz (suggests 221–224 MHz); phone only; 100 watts maximum power; no code test. Would not change Citizens Band rules.

f. RM-1841 (United CB'ers of America) filed July 1, 1971 – Proposes to use 27 MHz for "Hobby (Class H)" use only; transfer "all emergency and call channel operations" to 220 MHz.

3. All of the foregoing petitions propose, in various ways, Citizens Radio use of a portion of the band 220–225 MHz and will be considered in this proceeding. The most detailed petition was submitted by the Electronic Industries Association (EIA). As proposed by EIA in RM-1747 a new Class E category in the Citizens Radio Service would be created for the same type of use now authorized to Class D category stations, i.e., personal and business radiocommunications. As proposed, the Class E category would provide 80 FM channels occupying 2 MHz within the 220–225 MHz frequency band. Channels would be allocated for specific types of communications, e.g., intra-station, inter-station, business, weather advisory, emergency, marine, in-plant, traffic control, etc. Most Class E stations would be authorized 25 watts power output. A small number of channels would be reserved for one watt, local use stations. Certain public safety agencies would be licensed to operate Class E stations at 100 watts for use in emergencies. Antenna structures could be either 20 feet above the nearest man-made or natural object within 500 yards, or 60 feet above existing terrain. Licensees would be required to notify the Commission and the Federal Aviation Administration should antenna height exceed the maximum permitted near airports. The petition proposes a simplified licensing procedure which includes self-assigned station call signs. The petition further proposes that a station could be placed into operation immediately upon filing of the application and, should the Commission fail to act upon the application within 30 days, the license would automatically become validated. While the petition does not contain an estimate of the size potential for the proposed Class E category, informal estimates run as high as 10 million licensees. The Commission is also in receipt of considerable correspondence both in favor and in opposition to the reallocation of the band for any uses other than are now authorized. The American Radio Relay League, Inc., (ARRL) has filed a petition in opposition to that of EIA (RM-1747) requesting denial of the EIA petition and that the Commission issue a notice of inquiry inviting suggestions and proposals for increasing the efficiency and effectiveness of the Citizens Radio Service.

4. The band 220–225 MHz is currently allocated internationally in Region 2 to the Amateur and Radiolocation services on a co-equal basis. Nationally, however, Radiolocation is the primary service and Amateur the secondary service. The latter service is further constrained by footnote NG13 to the national Table of Frequency Allocations specifying that in an area in Texas and New Mexico about 175 miles wide and 110 miles in latitude centered essentially on the White Sands Missile Range, normal amateur operations are not permitted in the band between 5:00 AM and 6:00 PM, Monday through Friday. In view of the Government use of the band for radiolocation, the Commission has inquired as to the possibility of the band being shared with some form of Citizens Radio Service operations. The Director of the Office of Telecommunications Policy has advised that sharing to accommodate additional operations of a disciplined Citizens Radio Service would be practicable in the band 223–225 MHz. Such use would be subject to reception of possible interference from radiolocation operations, particularly in coastal, North Central and the North-

". . .220–225 MHz is currently allocated internationally in Region 2 to the Amateur and Radiolocation services on a co-equal basis. . ."

western areas of the United States. Moreover, operations would not be permitted between the hours of 5:00 AM and 6:00 PM, Monday through Friday in the areas around the White Sands Missile Range, New Mexico, and in Franklin and Gulf counties in northwest Florida.

5. As implied above, the use of a portion of the band 220–225 MHz for other than Amateur or Radiolocation services would be a derogation of the international Table of Frequency Allocations of which the United States is a proponent. Therefore, it is possible that objections from Canada and Mexico may require a prohibition against any other operations in some border areas. Pending resolution of that matter, mobile stations would be constrained from operations within ten miles of the border and base stations within 25 miles of the border. If suitable arrangements with Canada and Mexico can be effected, this prohibition may be modified to conform to the nature of the agreement.

6. The Citizens Radio Service was established by the Commission in 1945 (Docket No. 6651) as a radio communication service of fixed, land, and mobile stations intended for short distance personal or business communications, and for radio signalling and control of remote devices by radio. Due to a lack of suitable low cost equipment for the then existing Classes A, B, and C services, Citizens Radio grew slowly and reached a total of only 40,000 licensees by 1958. At that time it was decided to establish a Class D Citizens Service in the 27 MHz region to permit voice communications of a general or business nature. Although interference had to be accepted from Industrial, Scientific and Medical (ISM) equipment, to which the frequency of 27.12 MHz was primarily allocated, it was believed the Citizens Radio Service, due to its relatively low priority, could nevertheless make effective use of the spectrum. Consequently, although not ideally suited to the short distance concept of the Citizens Radio Service because of its sporadic long distance transmission characteristics, the 27 MHz region was allocated for such use. It was expected that equipment operating in the 27 MHz band could be produced at considerably less expense than equipment operating in VHF or UHF bands. Growth has been phenomenal, with the number of licensees increasing from 49,000 in 1959 to 868,013 in 1971.

7. The 27 MHz Class D Citizens band is divided into twenty-three channels with seven channels authorized for communications between units of different stations and one channel to be used solely for emergency communications involving the immediate safety of life and the immediate protection of property, or communications necessary to render assistance to a motorist. A wide variety of communications is permitted in the Class D Citizens Radio Service. As the number of licensees increased, however, so did complaints against the use of the service for the transmission of long duration base-to-base messages, hobby type communications, technical violations such as use of high powered amplifiers, and general pollution of the spectrum. Such abuses resulted in certain prohibitions against the Class D CB Service, including: (1) communications as a hobby or diversion; (2) transmission of obscene, indecent or profane words, language or meaning; (3) communications not directed to specific stations or persons; (4) the transmission of advertising or soliciting the sale of any goods or services; (5) transmission of music, whistling, sound effects or any material for amusement or entertainment purposes; (6) communications about the technical performance of equipment; (7) relaying messages for a person other than the licensee or member of his immediate family.

8. The Commission has been examining a number of various proposals directed toward promoting the effective use of the Citizens Radio Service or reducing widespread Rule violations. These proposals will be the subject of further Commission inquiries and proceedings with regard to Class D enforcement problems. The immediate proceeding, however, will address only the possibility of allocating additional frequencies to meet the requirements of the general public for improved radiocommunication services not now effectively provided by the Class D Citizens Radio Service and, at the same time, relieve some of the heavy concentration of stations on channels available to the Class D service. Such stations constituted nearly 47% of the total number of radio stations authorized by the Commission, as of June 30, 1971.

9. The Commission proposes in this proceeding to establish a form of fixed and mobile service in the band 224–225 MHz. The band would be divided into 40 channels at 25 kHz spacing. Eligibility for this service would be similar to that for the present Class D service, i.e., any person eighteen years and older who meets the basic criteria for Commission licensing. However, the Commission does not intend that the abuses of its Class D rules, and associated enforcement problems, shall be extended to this new service. Accordingly, before this service is permitted to become operational the Commission will establish new Class E rules and enforcement procedures, based on the information provided in response to paragraph 10 of this Notice and such other relevant information as it deems appropriate.

". . .the Commission does not intend that the abuses of its Class D rules, and associated enforcement problems, shall be extended to this new service."

10. With a view toward achieving the above objectives regarding the reallocation of the band 224–225 MHz specific comments and substantiating data are invited on the following:

a. Specific services and types of operations which should be provided, including limitations and reasons therefor. Estimated growth over 10-year period.

b. Economic sociological and other public interest benefits which would be derived.

c. Effect on Class D Citizens Band operations at 27 MHz.

d. Nature and probable impact of operational limitations imposed as a result of interagency and international objections or conditions of use.

e. Detailed technical parameters which should be adopted regarding equipment to be used, including detailed studies of extent of effective coverage and use to be expected in different environments such as urban areas with high density population. In addition, detailed recommendations should be made regarding total spectrum space required to meet various objectives, channeling, maximum power, an-

(con't. on page 91)

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

THE AMATEUR'S INTERCOM

A duplex intercom that operates on broadcast frequencies.

This article concerns a very useful item in anybody's shack or home, namely a two-way duplex radio type intercom that you will have a lot of fun making, tuning up and using. Most of the parts should be found in your junk box (mine is about 45 feet long now, but I have been at it for half a century, this year).

This project will take you right back to the good old days of 160 meters, even if you've never been there before. It's an "MOPA" (master oscillator-power amplifier) and it's on 160 meters. To be exact, one part is on 1600 kHz which, when I got my first license in 1923, was called "200 meters," and the other half is close to the good old ship band of 500 kHz.

The two receivers needed are already complete for you. If you think you can build them for *less* than $4.95, go ahead and try! Otherwise just buy two of them at Lafayette or Radio Shack. I did, and aside from the misery of the tiny edge-tuning dial, they do the job. Of course, for around $8.95 you can go hog-wild today and get "Direct Dial Tuning" and a "Large Three Inch Speaker!" (Just how large can a three-inch speaker get to be, anyway?) The sending units are easy to make, easy to tune up, easy to modulate and have a terrific collector dip, after the sometimes skimpy ones on VHF-UHF. Then you load up with the ac line plugged into the final, and you're in business. Your XYL should appreciate *this* one at least.

Bear in mind that on this project you *can* substitute almost anything.

Transmitter

So here we go. Figure 1 shows the schematic of one transmitter. The layout can be your own. I built mine in a black plastic piece of pipe and just plugged it in like a long light bulb. Nothing touchy about the circuit. The master oscillator oscillates and the power (99 mW!) amplifier amplifies. Q1 and Q2 are any old transistors that reach 30 MHz, or even good audio ones. I happened to have some 2N4249's and they worked well at 1600 kHz, so in they went. I also tried some VHF units, HEP 55's to be specific, and they were too lively for use at those low frequencies. Q1 is the oscillator, with emitter feedback from L1. L1 is No. 34 DCC (double cotton covered) with coil wax to hold it in place on a phenolic form about ½ cm O.D. and about 2.5 cm long with a threaded core inside. BC "loopsticks" are good, except for the taps. In fact you can use almost any kind of coil as long as you keep the turns ratios nearly as shown. Don't forget, you are on 200 meters, the high end of the BC band, and you can use plenty of C. I sometimes use up to 1000 pF around these frequencies.

Transistor Q2 is the amplifier and serves mainly to take the AM modulation. I tried to make the project go with a modulated oscillator, but zilch. No getting away with it. Just combined FM and AM with nothing in the center of the carrier and some kind of modulation on either side. You will find that

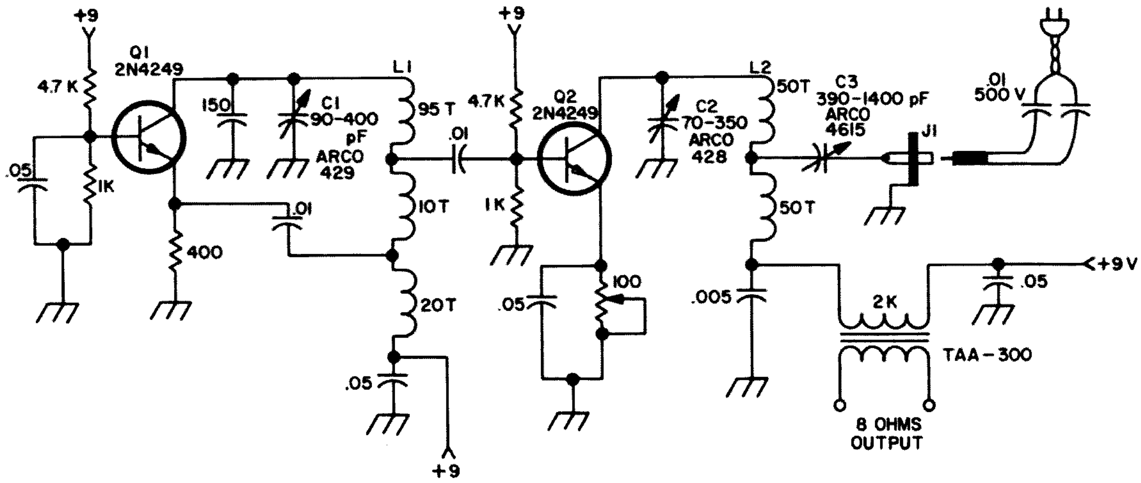


Fig. 1. Schematic of the 1600 kHz transmitter for the intercom. To get the second unit operating on 550 kHz, turns may have to be added to L1 and L2 – just be sure to keep the tap ratios the same.

Q2 works just the way the old tube sets used to. Remember those large old glass bottles your father worked with? When the oscillator Q1 is loaded into Q2, you can get up to 15 or 20 mils of collector current on Q2. Then when the circuit C2-L2 is tuned to 1600 kHz, a fine dip occurs, way down to a few mils. You can then load it back up with useful energy into the line, or a test lamp, to 10 mils, or even 11 if you want to get the maximum allowed which is 100 mW. So with 9V you've got 99 mW.

You will be surprised, if you haven't tried it already, how you can load up your ac line with BC rf! The carrier will then be found all over the house, along with the really good modulation, if anyone is talking. The signal also goes to the cellar, garage, workroom or what have you.

Ac Supply

Just in case you don't have one lying around, or don't have an old defunct $9.95 ac-battery portable that you can survey, Fig. 2 shows an ac supply that I rigged up in an emergency. It works and doesn't have any hum in it that I could find, even when I used

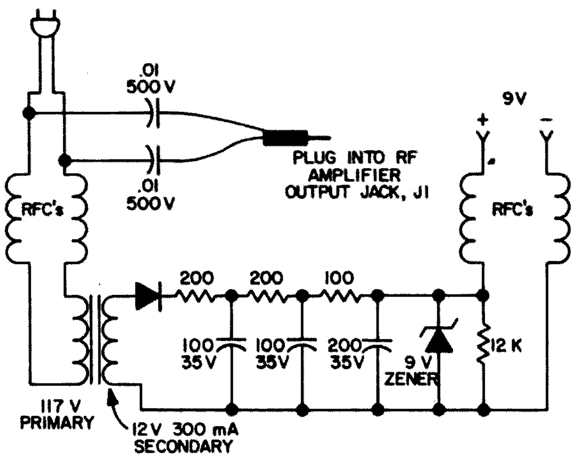


Fig. 2. A power supply that is built into the same case with the transmitter furnishes power while also connecting its output to the "ac line" antenna.

it with a 108 MHz FM oscillator-modulator combination. I did try for a minimum value of capacitors while still maintaining an absence of hum, just as a matter of cost, but again, it works. In this case, for radiation, you just plug the rf output right back into the ac line, which goes all over the house.

Receivers

I just went to one of the Radio Shacks and paid $9.90 for two of those 6 transistor radios with a 9V battery and a carrying strap (which I soon cut off because it's a nuisance). As mentioned, for around $10 each, you can do better, but these little $5 jobs have a certain feature which is quite interesting. As far as I know, they represent the greatest value of anything our technological world has produced so far – a sensitive superhet covering a frequency range of three to one, complete in a palm-size box, antenna, battery, etc., all for $5. They do require a "stand" though, to make them sit up on a table or shelf.

Modulator

I used the same dependable Amperex TAA-300 IC whose circuit is about ten years old by now and is well known to readers of *73 Magazine*. You can also use any of the solid state audio amplifiers, 100, 360 mW output, or 1W or 3W, for $4.95, $5.85, etc. Or build your own from your favorite chip. With the TAA-300 output of 8Ω I used an 8Ω to 2 KΩ transformer, as in Fig. 1. You

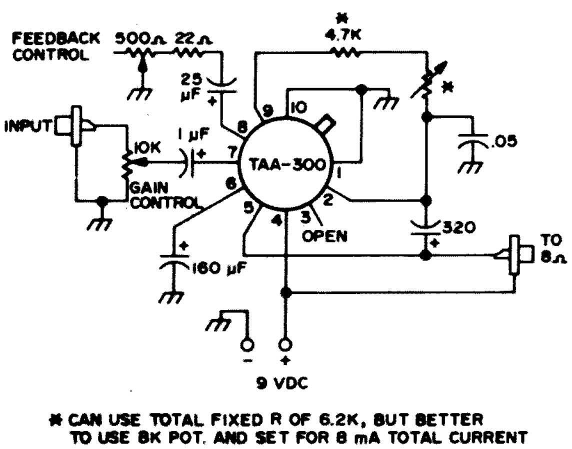


Fig. 3. The TAA300 IC was used for modulation, but any small amplifier will work equally well.

can use the same, or adjust an op amp output to around 2 KΩ, and modulate the final with that. Use any mike you please, beginning with the 1½ in. crystal mike cartride for 89¢ at Radio Shack. For hi-fi(?) response, use one of these in parallel with their dynamic mike cartridge. You might, just might, be surprised. Just listen to the modulator output direct into padded earphones. Again, Radio Shack, for less than $20, and very useful (no, I *don't* work for Radio Shack).

Testing

You should get enough rf output out of J1 to light a No. 48 bulb (2V, 60 mils, 120 mW). Maybe not too bright, but visible enough. Perhaps 50 mW, for example. The amplifier should also load well into the ac line with judicious use of C2 and C3. Run the amplifier with just a slight dip, but always *listen* to it. I use two methods, sometimes three. 1) Plug a good set of padded earphones of the hi-fi type which have two little loudspeakers inside into a good receiver and listen to it. 2) You can plug a good FM set into the modulator input for tests and listen around the house for field strength. Don't take the modulation for granted. Use a good AM set for these tests. 3) Use a diode receiver with good af.

As a final test, do the same with one of the $5 sets. For duplex tests, tune up a second sender on or near 550 kHz, and use the second $5 receiver. You may have to increase the number of turns on L1 and L2 for this. A BC loopstick will always do it if you don't want to wind your own, but you'll have to rewind for taps. Now plug one transmitter into the line in your shack, for example, and the second in the kitchen or near the TV set if your XYL is a soap opera addict, or even in the library if she is the intellectucal type – and, *voila*, DUPLEX. You will find you can talk most anywhere in a room and the mike will pick it up. Use lots of modulator gain and only a little on the receiver, to keep sound wave feedback down. There is also one of those miserable little earphones with each $5 set, if you can stand it plugged into your ear. Have fun – that's what this one is all about!

. . .K1CLL

LETTERS

FM OPTIMISM

Having lived for the past 2½ years alternately in blighted parts of the country where there is no 2 meter activity, and in parts of the world where there is no ham activity at all, I have watched the FM scene develop through the pages of 73 with great interest and a growing desire to join the fun when I return to the states. At least that was true until a few months ago when the new repeater rules were released. The results of this stultifying act are starting to come in, none of them good. FM will of course carry on somehow, but what is left may not be worth bothering with. Either FM as it is known or the FCC is going to have to give, and when was the last time that you remember a government bureau admitting a big mistake was made?

Alan P. Biddle WA4SCA/BV2
APO San Francisco CA

RTTY GEAR NEEDED

Would appreciate being put in touch with an RTTY ham who would be willing to ship some gear out here. That is, to organize the purchase, etc., of the gear and on receipt of my cheque to ship it out.

Very little RTTY gear is available out here.

Appreciate 73 very much.

A. A. O'Brien VK2BOA
P.O. Box 57
Port Stephens Street 2324
N.S.W. Australia

FCC DIRECTIONLESS?

A funny thing happened to me on the way to my repeater license (WR7ABA). After two months of waiting and no word from the FCC, other than my cancelled check, I received a collect, long distance phone call from Rick Hambly who is secretary of the Tompkins County Radio Club in Ithaca, New York.

He informed me that they had just received their new repeater call from the FCC (WR2ABD) and as a bonus the Commission had included my repeater license with it! What a way to find out my license had been issued!

So, you might tell the readers that they better double check the name on their new license before they get the ID'er all changed. Hi, Hi.

Jeffrey Bishop W7CTX
Boise, Idaho

JUNE 13--2M DX?

This morning at 0850 CST monitoring local 146.94 direct here in Mexico City a W4 mobile in Okeechobee, Florida suddenly broke the squelch on my Standard 826 calling QRZ. I immediately answered and he correctly acknowledged my call (XE1WS), every bit as surprised as I was or more so. I caught his call sign also but promptly forgot it in the excitement of the moment before I had a chance to write it down. Within about 30 seconds conditions were out, and I am therefore pretty sure it was a meteor scatter contact. Distance from Mexico City to Okeechobee, Florida is about 1780 airline miles!

As you can imagine, I am very anxious to determine who I worked and perhaps if you can run a short note on this incident in the next 73, I may be able to find out. Since he copied my call he may just drop me a QSL, but who knows, even though XE's are super DX on 2 meters. Anything you can publish to help would be greatly appreciated.

Also, for your general information which you may want to publish, there is growing activity on 2 meter FM in Mexico with all the activity centered around Mexico City. Operating norms are about the same as in the U.S. Almost all activity is presently 94 direct but we will have our first open repeater operating in about 3 weeks on 16/76. Equipment is Standard RPT-1, tower height is 125 ft. located in the hills on the west edge of town overlooking all of Mexico City. Antennas are Hustler 6 dB-receive/Cush Craft stacked dipoles 6 dB omnitransit. Call sign XE1WS (my call) but the repeater is a joint project of the Assocation VHF de Mexico (our local repeater club). QTH is OK in the call book for XE1WS.

R.N. Green XE1WS ex W2GFO
Palmas 1460
Mexico 10, D.F.
Mexico

COUNTER STEP NO. 2

Now that Peter Stark has had his fine counter "Lily Gilded" in your last issue I have an idea that I incorporated when I built mine last summer and you get it almost for free.

I noticed that the LED readouts on digital calculators all had decimal points that could be moved at will with a switch. Looking at the specs for the Man-1 LED readout in my counter, I saw that pin six was the decimal point cathode which would light if grounded through a 220 ohm resistor.

The decimal point should light only with the kHz/Hz switch in the Hz position and with three digits to the right of the decimal point with the Hi/Lo switch in the Lo position, and with two digits to the right with the Hi/Lo switch in the Hi position.

Replace the SPST kHz/Hz with a DPDT. Ground the center of the added section through a 220 ohm ¼ watt resistor. From the circuit that is completed with the switch in the Hi position run a lead to the center of an additional section of the Hi/Lo switch which is now a Triple-pole DT instead of DPDT. The other terminals of the added switch section have leads to pin six of the center readout for "Lo" and the next readout to the right for Hi.

It is nice to have the decimal point show up without having to think about it each time, particularly in the right place!

If one wanted to be really chintzy one could arrange to have the decimal point on the leftmost readout serve as an over-range indicator instead of a separate LED.

Edson B. Snow W2UN
Rochester, New York

GOOD VIBES

Keep up the fine work on your magazine. It is tops as far as I can ascertain! I will continue to read it until it is no longer readable or I am no longer able to read! I will be going to the land of DX soon for about six months and as soon as I am allowed to I will send a change of address and also my call and operating frequencies/hours.

Bob Hughes
Alexandria, Louisiana

READ THAT METER

When in your January issue you announced that 73 was going Metric, I applauded your stand and then leaned back to see what developed. Now I was prepared to forget little things such as 6-32 screws and the like. However, an error such as appeared in your April issue (and by an Editorial Staff member at that) I find difficult to forgive. I am referring to W7DXX's article "2 Meter FM at 14,000 Feet," Shouldn't that be "2 Meter FM at 4267.2 Meters"?

Kenneth J. Koster WA7RYP/Ø
Bismarck, North Dakota

By golly, you're right... 4267.2 meter FM on 2 meters!

PAY TV – 1947 STYLE

Sooner or later everything turns up in the surplus market, and sooner or later somebody usually buys it at a bargain price.

I got a nostalgic twinge as I read Meshna's advertisement (as I always do) on page 138 of 73 for May. There it was – the whole bag of tricks in

(Continued on p. 96)

J. Houser K2EEE
Bill Noah III, W2JKI
23 Washington Street
Rensselaer NY 12144

NOVEL 160 M ANTENNA

You can have an antenna like this almost anywhere. Limited space means almost nothing. It can be fitted to accommodate the contour of just about any size or shape of building or lot. As a restricted-space antenna on 160 meters, it proved to be the answer to a maiden's prayer.

If you have a very noisy location, consider that an antenna of this type has probably the lowest noise factor of anything you could erect. Static discharges are really minimal. While lightning direct hits can ruin just about any equipment, the chances with an antenna of this type would be less than most conventional antennas if a small spark gap across each meter is provided.

This is a nominally *grounded* antenna – that is, one end is connected directly to ground – rather unconventional, but practical.

It is a random-length antenna. As long as you have *some* wire, somewhere, of reasonable length, it will radiate, and quite efficiently. The only drawback, if you can call it such, is that it takes two to tango – i.e., two guys to properly adjust it. But when properly adjusted, the swr should be around 1.1 at the tuned frequency, and not more than 1.5 when 25 kHz away either way (at 160) which covered the whole 160 meter band nicely without subsequent adjustments, if tuned for the center frequency of the band.

The coil at the feedline end is not grounded but the coax connector can be easily strapped right to a nearby pipe.

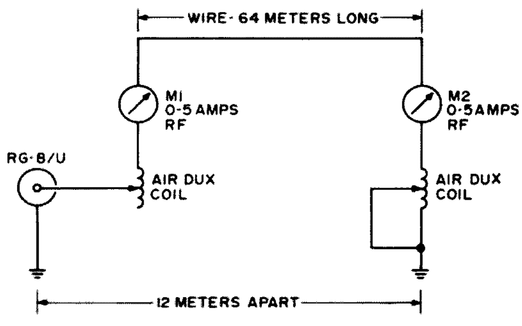


Fig. 1.

The antenna Bill W2JKI put up for 160 has 64 meters of wire. It is strung from the first tuner in the basement out through a basement window, up alongside the house (with standoffs), and around the side of the house (near the top) at roof level. From there it runs up at an angle to a tower, back down to a pole near the front of the house, and from this pole down the front side of the house (on standoffs) to a window in the front of the basement, through it, and down to the second tuner and grounded. (Whew!)

Note from the diagrams that two tuners and two meters are required. The meters actually should be a matched pair if possible, i.e., of same make and range. Two 0–5A rf meters were used, 2% accuracy.

The two tuners were identical Air Dux coils 6.35 cm in diameter, 14-gage wire, spaced, with 40 turns per coil. For 160 about half the turns were used. The coils could have been half the number of turns, actually. For any higher frequency bands, far less turns would be satisfactory, depending of course on the amount of wire between the two. The two coils are about 60 feet from each other (the length of the basement), so no inductive effect was noticed.

The grounds at each end were positive. In addition to making use of the water pipes, three 250 cm ground rods were driven at the feed end, and one at the grounded end. The water pipes all through the house acted as a counterpoise-ground.

The tuning is a matter of cut-and-try, tapping down from the zero-turns end of each coil one turn at a time (equally) until

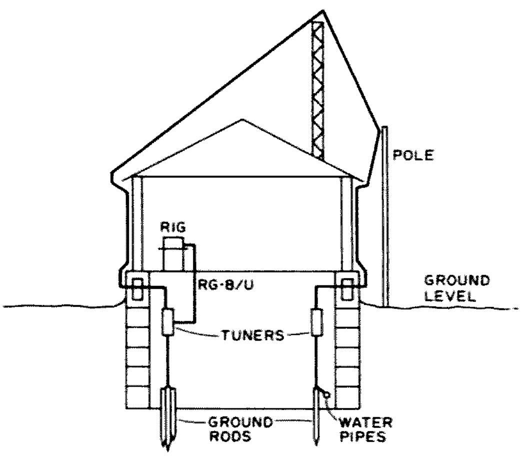
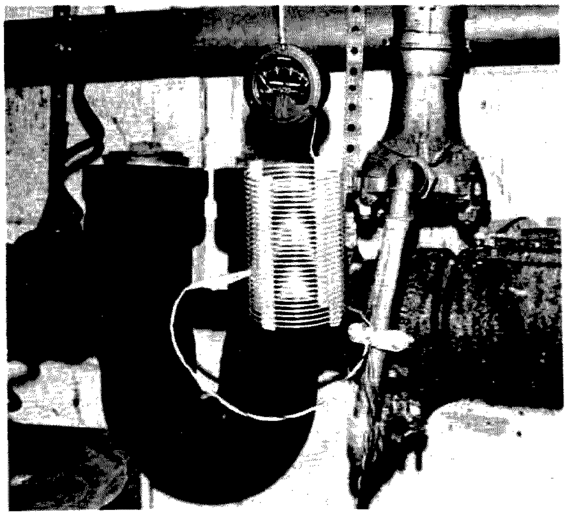


Fig. 2.



Note the interesting arrangement at the grounded end. Make sure of solid contacts to prevent backup of that high energy rf!

each meter reads the same as the other, at which point the antenna will be tuned and the 50Ω feed point from the RG8/U cable matched.

One very good reason why we know the antenna was more efficent than most on 160 was that for about equal power QSO's the S-meter readings were better on reception than the readings on the other ends. On transmission, better reports were received than other stations like distances away with comparable powers and different antennas. How you hear the other guy and how well he hears you is still the best criterion as to how efficient your antenna is.

The principle of operation of an antenna of this type seems rather obscure. It might be compared to a radiating transmission line, with equal current at each end, balanced.

The photographs show the coils at the feed end and at the grounded end. The plumbing is thrown in for background.

We know this antenna worked well on 160. Further evaluation of its merits will necessarily have to wait until many hams try something similar on 80, 40 and 20.

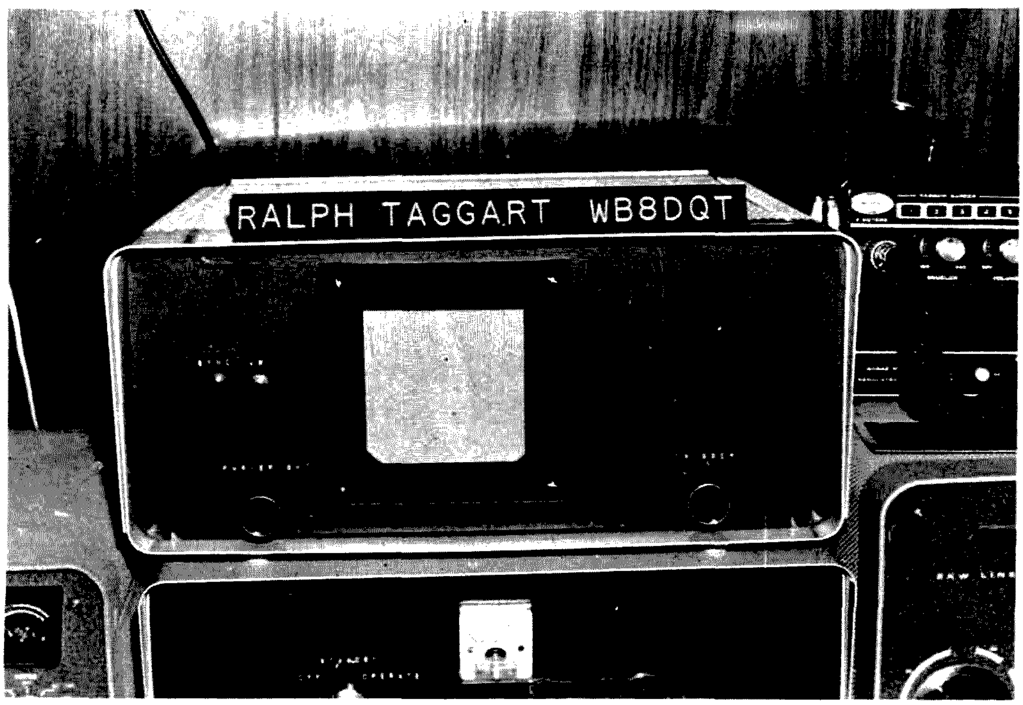
We would have only one caution – if you have children or pets around, be very careful as to where and how you run the wires out of and into the house or basement so as to avoid the possibility of contact as there is a respectable amount of rf present.

. . .W2JKI & K2EE

A BASIC SOLID-STATE SLOW SCAN TELEVISION MONITOR

Ralph E. Taggart WB8DQT
4515 Oakwood Drive
Okemos MI 48864

The first requirement for a newcomer to SSTV is to acquire a monitor. The basic goal behind the design of the unit described here was to develop a basic monitor with good performance while keeping the component count and circuit complexity to an absolute minimum. The resulting circuit uses a magnetically deflected cathode ray tube (CRT) for bright picture display and is relatively simple in concept and construction. The circuit was designed around readily available over-the-counter parts to mimimize procurement problems which often plague the home brew fanatic these days. If minimum cost is a factor, extensive substitution of surplus and bargain parts is possible and guide lines are provided following the circuit description. A well-stocked distributor should have virtually all of the components called for with the exception of the CRT which will probably have to be special-ordered. If the monitor is built in the modular form recommended, it is possible to experiment with new circuit ideas as they become available, thus gradually updating the circuit. As described, the



Front view of the slow scan monitor. The two operational controls are the on/off - brightness control on the lower left and the sync trigger control on the lower right. Immediately to the left of the CRT bezel is the manual vertical reset button and left of this is the LED tuning indicator.

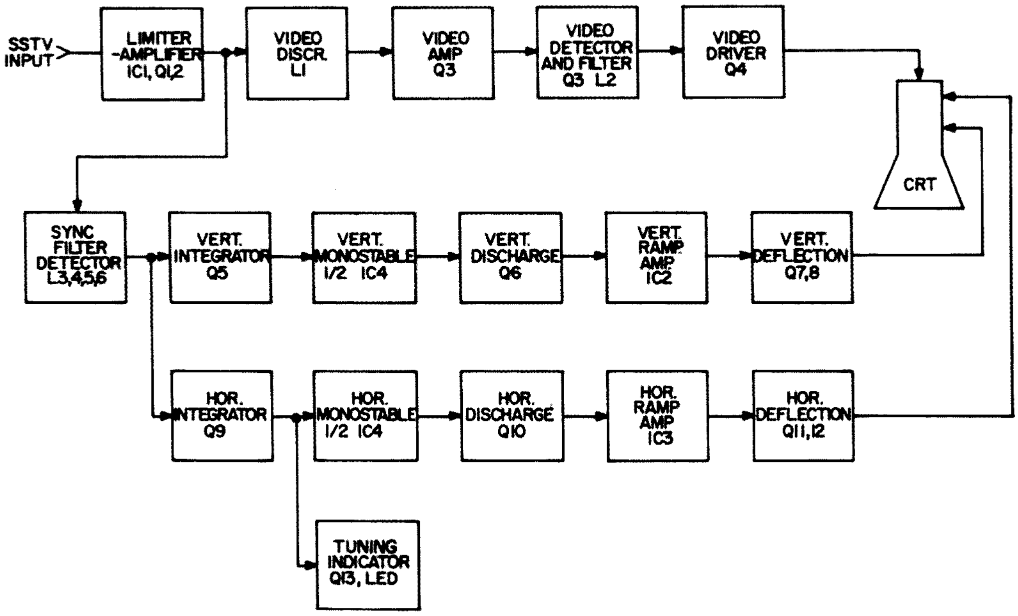


Fig. 1. Block diagram of the WB8DQT SSTV monitor.

circuit will recover excellent pictures under any but the worst conditions of noise or QRM.

Circuit Description

The SSTV picture is transmitted as an audio tone of varying frequency. Sync pulses to start each line and frame are sent as bursts of 1200 Hz while light intensity values between black and white are transmitted by varying the tone between 1500 Hz (black) to 2300 Hz (white). A monitor circuit must separate out the 1200 Hz sync pulses and use them to control the scanning of the monitor CRT and must also utilize the video frequency shift to bias off the CRT to provide brightness variations on the monitor screen. A block diagram of the monitor circuit elements is reproduced in Fig. 1 and will be referred to in the following description.

Since the picture information is transmitted as a tone of varying frequency, we want to remove all amplitude variations in the incoming signal caused by factors such as fading, variations in input level at the transmitter, changes in receiver gain controls, etc. IC1 functions as an audio frequency limiter to perform this function and is followed by a fixed gain audio amplifier (Q1 and Q2) to provide sufficient signal level to drive the other circuits. Video information is recovered by passing this signal through a 2300 Hz tuned circuit (L_1) which acts as a video discriminator. The black and white frequency limits will be used for the purpose of illustration but a linear response between black and white may be assumed in visualizing the reproduction of intermediate grey values. The output of the discriminator is a signal whose amplitude varies from a relatively high value for black (1500 Hz) to a relatively low value for white (2300 Hz). This amplitude "modulated" signal is fed to Q3 and is further amplified. Variable gain is incorporated in this stage for contrast control. The output of Q3 is detected, providing a relatively higher dc voltage during black portions of the picture and a low dc output when white is being transmitted. This varying dc level is used to drive a high voltage transistor, Q4, which is connected to vary the grid bias on the CRT. At the optimum setting of the contrast control, the relatively high dc output of the video detector will bias off the CRT during black portions of the picture, causing the CRT beam to be extinguished and producing a dark display on the screen. The low output of the detector during white portions of the picture has a minimal effect on the CRT bias, the beam is almost at full intensity, and a white display (actually bright yellow due to the type of phosphor required) results. A long

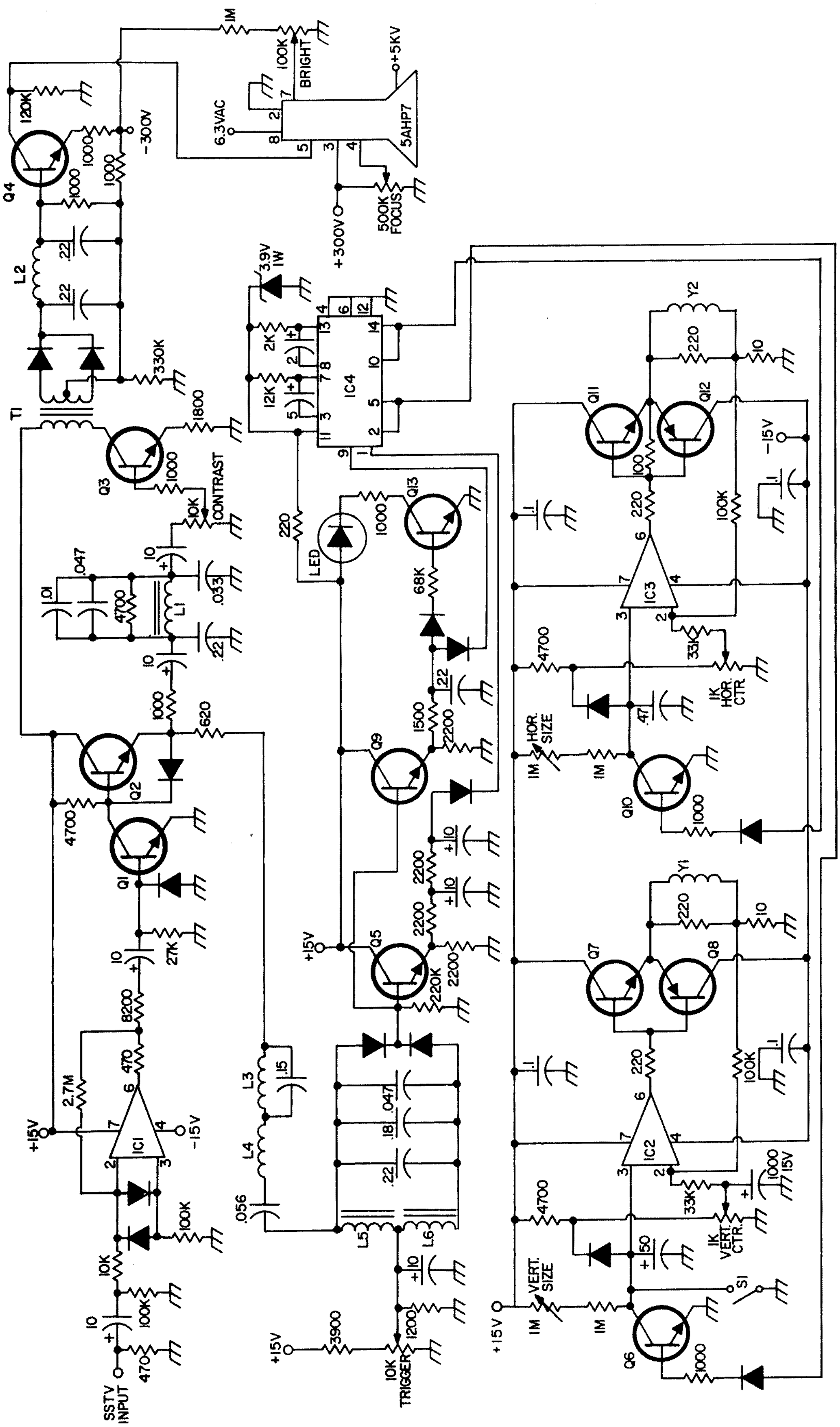


Fig. 2. Schematic of the WB8DQT SSTV monitor. See parts list on following page.

PARTS LIST

Q1,2,3,5,6,9,10,13 – HEP 55; Q4 – HEP 240; Q7,11 – HEP 245; Q8,12 – HEP 246; IC1,2,3 – HEP C6052P or C60536; IC4 – HEP 570; All unmarked diodes – 1N457, 1N914 or general purpose rectifiers; all resistors 1/2W; All capacitors in mF – decimal values are 100V tubular Mylar, electrolytics are 25V unless otherwise designated; contrast, vertical and horizonal size and center pots are 1/4W PC pots; all other pots are 1/2–2W units; Y1,2 – both coils incorporated in standard 70–90° TV deflection yoke (Stancor DY-21 or equiv.); S1 – manual vertical reset – pushbutton switch; T1 – Triad TY-27XT (500:500Ω CT); L1,4 – Triad EA-100 toroid (100 mH); L2 – Triad C-27X filter choke (0.7H); L3 – Triad EA-070 toroid (70 mH); L5,6 – Triad EA-020 toroid (20 mH); LED – Industrial Devices Inc. 2190LI-12V – other LED's may be used if resistor values are altered to accommodate their voltage and current ratings; front panel controls – brightness, trigger, LED, manual vertical reset.

persistence (P7) phosphor is used so that the video information may be viewed in its entirety despite the extended frame time.

Output from Q2 is also fed through a series filter (L3, L4) to a 1200 Hz tuned circuit (L5, L6) where the sync pulses are detected. Output of the sync detector drives Q5 which is set up to integrate the relatively long vertical sync pulse (30 ms) while rejecting the shorter horizontal pulses. The output of Q5 is a 30 ms dc pulse which is fed to one half of IC4 which is wired as a monostable multivibrator. The rectified vertical pulse, which may be noisy, distorted by multipath, or of incorrect length, depending upon the setup of the camera, is used to trigger the monostable which generates a clean 30 ms pulse. The output pulse from the monostable is used to turn on Q6 for the duration of the pulse and effectively shorts the 50 μF vertical discharge capacitor to ground. At the end of a vertical sync pulse Q6 goes "off" and the capacitor begins to charge through the 1 meg resistor and 1 meg size control in the collector circuit, producing a ramp voltage. This voltage drives IC2 which amplifies it and in turn drives a complimentary pair output stage (Q7 and Q8) which provides deflection to the CRT through the vertical windings of a standard TV yoke coil. The operation of the horizontal stages is similar except for the time constants involved. Q9 serves as the horizontal sync integrator driving ½ of IC4 which drives Q10 to generate the horizontal ramp voltage which is amplified by IC3 and used to drive the horizontal output stage consisting of Q11 and Q12 which in turn drives the horizontal windings of the CRT yoke assembly. Dc pulses from Q9 are also used to drive Q13 which functions as a solid-state switch and turns "on" an LED tuning indicator whenever a sync pulse is present in the passband of the sync detector. This provides a convenient tuning indicator since the sync pulses will only appear in the narrow "window" of the sync detector when the station SSB receiver is tuned for proper carrier insertion.

The suggested power supply circuit is straightforward and provides regulated plus and minus 15V outputs for the solid state circuits and plus and minus 300V, unregulated, for the CRT circuit. The CRT requires between 6 and 10 KV for acceleration voltage. This is provided by a HV module available from Robot Research which is powered by the low voltage supply.

Construction

The monitor can be assembled in almost any fashion that permits proper interconnection of the circuit elements, but certain points deserve mention. It is highly desirable to remote the power supply circuit from the monitor itself to prevent distortion of the CRT scanning beam by magnetic fields from

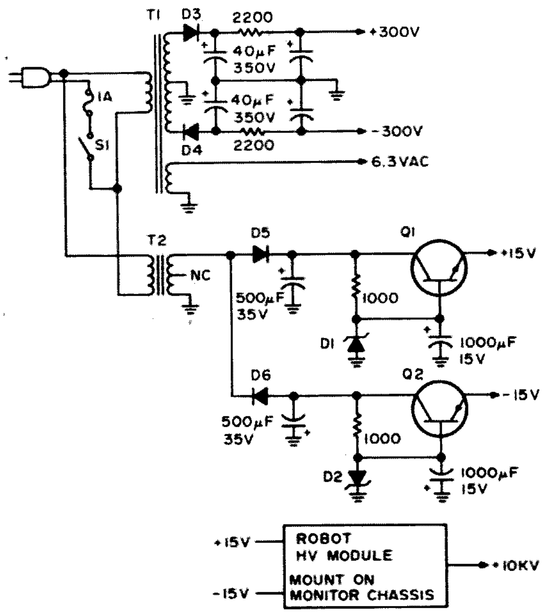
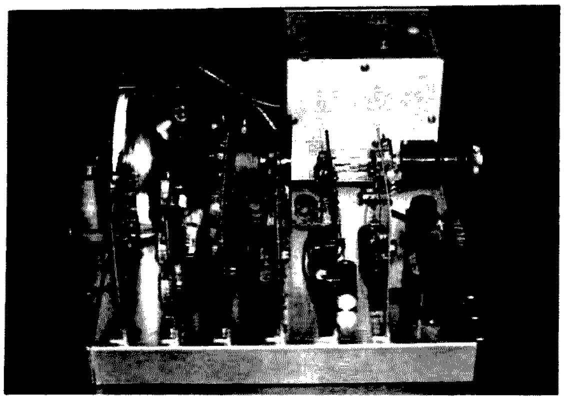


Fig. 3. Suggested power supply for WB8DQT SSTV monitor. T1 – Triad R-6A – 480 VCT 50 mA, 6.35V 2A; T2 – Stancor P8357 – 25V 2A; D1, 2 – 15V 1W zeners (HEP Z0418); D3-6 – 1000 PIV 1A (HEP 170); Q1 – HEP 247; Q2 – IR TR29.

the power transformers. The power supply can be interconnected to the monitor via a multiconductor cable. In my own case I used a SPST switch on the brightness control to turn the supply on remotely using two additional conductors in the interconnecting cable. The HV assembly should be mounted directly on the monitor chassis.

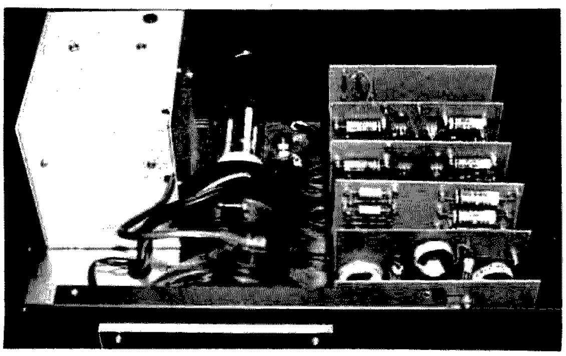


Side view of the monitor with the cabinet removed. The small transformer located behind the circuit boards is the video filter choke (L2) with the contrast control next to it. The individual circuit board assemblies are mounted to the chassis using aluminum brackets. The CRT and deflection yoke assembly are mounted near the center of the chassis with the Robot Research HV module in the metal box on the far side.

In the case of my monitor I constructed the different circuit elements on discrete circuit boards. I would suggest the following breakdown:

Board 1: Limiter and input amplifier.
Board 2: Sync detector and vertical and horizontal integrators.
Board 3: Vertical deflection circuits.
Board 4: Horizontal deflection circuits.
Board 5: Video discriminator and video circuits. Sharp-eyed readers will note six boards in the monitor illustrated. This version incorporates an additional board for all the toroids and associated capacitors and although this works fine, fewer interconnections are required if the tuned circuits are placed on the other circuit boards.

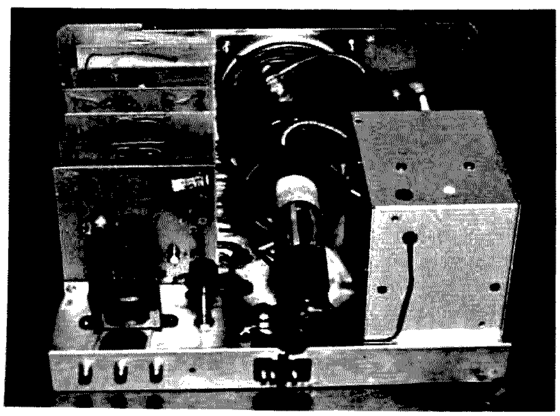
The boards can be conventional pc types but this means quite a bit of work unless you want to mass produce monitors as part of a group project. Vector board can be used



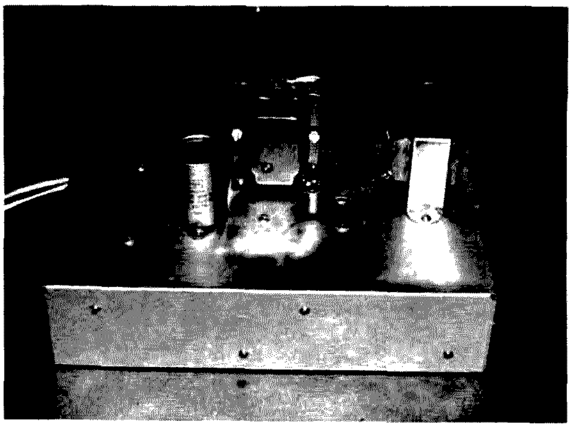
Oblique front view of the monitor showing the method used to mount components on the unclad PC stock.

but all those unused holes look kind of messy. In my own case I worked up a full scale layout on a piece of paper the same size as the final board, taped this template to a piece of glass board stock (without copper) and drilled holes for the small vector pins only where required for the layout. This makes a very neat arrangement which looks almost as good as a printed board when finished.

The brightness (plus on/off) and sync trigger controls are the ones which have to be mounted on the front panel. The manual vertical reset pushbutton switch and the LED indicator should also go on the front panel. The contrast control can be mounted on the chassis for easy access but need not be adjusted following initial setup. All other pots can be ¼W trimmers and are best located on their respective circuit boards



Rear view of the monitor. The HV module is on the right, the circuit boards, video filter choke (L2) and contrast control are on the left. The focus pot is mounted on the chassis just below and to the left of the CRT base.



The remote power supply for the monitor.

since they are usually not adjusted after initial setup of the monitor.

An LMB CO-1 cabinet makes an attractive package for the monitor, but you might wish to consider a cabinet styled to match existing gear in the shack. A suitable bezel for the CRT can be expensive and difficult to obtain. I solved this problem by using a 13 cm square piece of plexiglass backed up with a piece of black construction paper with an 8 cm square cutout to define the viewing area. A sheet of yellow acetate plastic may be placed between the CRT face and the rear of the front panel to mark out the bright blue flash characteristic of the P7 phosphor, permitting easier viewing of the persistent yellow video display.

Parts Substitutions

The single most expensive item is the 5AHP7A tube specified. This is a modern, electrostatically focused CRT with an aluminized phosphor which provides excellent performance in this application. As far as I know, this tube is not available on the surplus market. The 5FP7, a common surplus item, can be used with only two modifications. First of all the focus pot specified should be deleted and, secondly, a permanent magnet focus coil assembly such as the Quam "Focalizer" must be mounted on the CRT neck in back of the deflection coil assembly. These units were used on many models of early tube-type TV sets and the junkers in local TV service shops are your best (and cheapest) source.

Deflection coil values are not at all critical and virtually any deflection coil assembly can be used as long as it will physically fit the neck of the CRT.

Most of the transistors specified (Q1-6,9,10,13) are general purpose NPN types (2N718, 2N3391, etc.) so surplus bargains are fine. Be sure to test them first, however, if your source is suspect. Q4 is an NPN unit with a 300V rating – otherwise it is not critical. The complimentary pairs (NPN - PNP) in the output of the deflection stages can be any complimentary pair types rated at at least 30W. The NPN and PNP transistors in the power supply regulators are general purpose power types in TO-3 cases. They drop approximately 10V in the circuit shown and will get very hot unless properly heat-sinked.

The HEP ICs specified for IC1-3 are op-amps in 8 pin TO-5 or mini-DIP packages. 741 op-amps in either the TO-5 or mini-DIP packages can be substituted with no change in pin numbering. These ICs are readily available and quite cheap. 709 op-amps in the TO-5 package may also be used with no basing changes but these must be frequency compensated by the *addition* of a few more components. Figure 4 indicates what

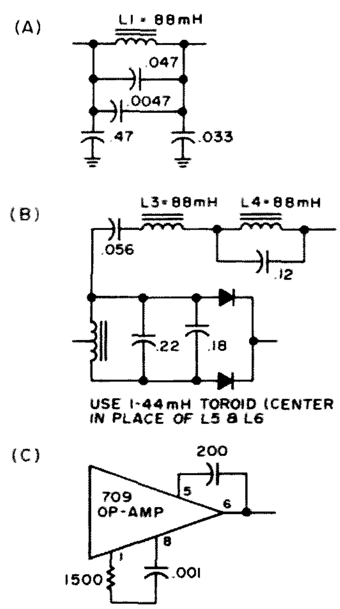
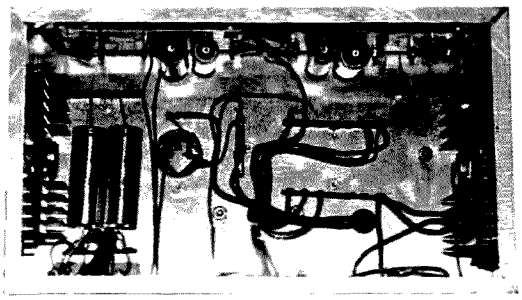


Fig. 4. Modifications of WB8DQT monitor when using surplus components. (A) Modifications of discriminator when 88 mH toroid is used for L1. (b) Sync circuit modifications for use of 88 and 44 mH toroids. (c) Additional components required for frequency compensation when 709 op amps are substituted for IC1, 2, and 3.



View of the underside of the power supply chassis. The LV supply components are mounted on individual boards mounted on the side of the chassis in the upper part of the picture with the exception of the regulating transistors which are mounted on individual heat sinks on either end of the chassis.

changes must be made. IC4 is a Quad 2-input gate which can be replaced with a Motorola MC-824P.

The toroids specified are relatively inexpensive Triad types since the availability of surplus toroids becomes more variable as time goes by. Figure 4 also shows changes in the tuned circuits which can be mady to incorporate surplus 88 and 44 mH toroids if you have a source of supply.

You can save money by building a HV supply rather than using the module specified (see article by W9LUO in March '71 *QST* or various circuits in the SSTV Handbook by *73*) but being lazy can sometimes be a virtue.

Initial Setup and Adjustment

This monitor cannot adequately be set up using a tape you record off the air. It achieves its resistance to QRM by using high Q coils in the sync section and tuning accuracy is so important that the chances of your getting the correct tuning operating blind are minimal. A recording obtained from another slow scanner or the test tape which Robot Research sells for a very modest cost is required. The latter tape is ideal in that it contains a grey scale pattern which is ideal for setting up the contrast control.

Start by setting contrast, vertical and horizontal size, and vertical and horizontal centering controls to mid-scale. Turn on the monitor but keep the brightness control turned down. As the CRT warms up adjust the triggering control through its range as a slow scan signal is fed into the input. You should note the LED tuning indicator flickering in time with the horizontal sync pulses over at least part of the range of the control. The indicator will brighten momentarily during the vertical sync pulse due to the longer duty cycle of this pulse. Turn up the brightness until the trace is just visible and use the horizontal centering control to move it into the viewing area. The horizontal size control is used to expand the trace to fill the viewing area. You should be able to get horizontal triggering over much of the range of the triggering control. Adjust the trigger control to the point where the picture will begin to scan downward but not past the point where it will fail to reset when a vertical sync pulse arrives. If the picture scans upward or the trace jumps to the bottom of the screen when the reset button is pushed you must reverse the vertical deflection leads. All of the size and centering controls should be optimized for a square picture that just fills the viewing area. The brightness can now be set at a comfortable viewing level, usually half scale or just a little beyond, and the contrast control adjusted for optimum grey scale rendition. With proper adjustment of this control the beam will be completely extinguished in black areas of the picture, white areas will have maximum brightness, and there will be a smooth grey scale response with all bars of

Monitor display from a transmission by W9VZL/3 (now W4UMF) and recorded in 1967.

the grey scale pattern clearly resolved. You will find that there is comparatively little interaction between brightness and contrast, so the brightness control can be varied without shifting overall video response. Since the monitor employs triggered sweep circuits the trace will move off the screen if no signal is present.

Actual operation of the monitor in conjunction with the station receiver consists of tuning the receiver for maximum brightness of the flickering sync display of the LED. If the receiver is tuned this way the monitor will trigger properly and the grey scale reproduction will be identical to that obtained with closed circuit tapes. The LED will brighten with any audio signal that falls in the sync detector passband as the receiver is tuned, but video information, noise, splatter and other interference sources will produce a random brightening quite unlike the normal sync display. Even a very weak fading signal can be tuned by peaking the indicator at the top of the fade cycle thus assuring that the monitor will be locked on the signal whenever it rises out of the noise. This tuning indicator has made it possible for me to track SSTV signals from OSCAR 6 despite rather pronounced Doppler shifts on overhead passes, thus insuring optimum video display at all times.

Photograph of a single frame from a transmission by WA9UHV relayed via OSCAR 6. The monitor maintains a stable display despite a low signal/noise ratio. A tuning indicator such as the one incorporated in this monitor circuit is almost a necessity to accurately track satellite signals due to the pronounced Doppler shift on the downlink transmitter, particularly during overhead passes.

Typical off-the-air picture display of a transmission from W4UMF.

The monitor performs very well in the presence of noise as shown by a photoggraph of a signal from WA9UHV received via the OSCAR 6 link. Other photographs have been included to show monitor performance under both closed circuit and on-the-air conditions.

. . .WB8DQT

Editor's Note:

To aid those who might wish to consider building this circuit, the author is selling two circuit board packages:

(1) MB-1 Etched circuit board. This glass epoxy board measures approximately 20 x 25 cm and contains virtually all of the active circuitry exclusive of the power supply. The board is designed to accommodate standard parts so the use of junk box components is possible. A parts layout sheet for the circuit board is included with a complete set of instructions for assembly, checkout and use. $9.95.

(2) WMB-1 Wired and tested circuit board. This is a completely wired and tested version of the circuit board, complete with the data package. The large LED used as a receiver tuning indicator is also included. The only additional components required for use with this package include a power supply, cabinet, CRT, a standard TV deflection yoke assembly, two pots, two ½W resistors, a pushbutton switch, and some hookup wire. This package represents an easy way to work up a quality monitor with no critical building or adjustment. $99.95

The circuits board are available immediately. Approximately two weeks delivery time will be required for the wired and tested version. Include a money order or cashiers check for the amount of purchase, and send to Ralph E. Taggart WB8DQT, 4515 Oakwood Drive, Okemos MI 48864, phone 517-349-1928 (evenings).

Thomas Harper
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Tampa FL 33612

LOW COST FREQUENCY COUNTER

A basic counter that. . .counts!

There are still a few hams who have not built a digital counter, due in some cases to misconceptions regarding the complexity of digital devices. The counter to be described is about as basic as a counter can get, is very inexpensive to build, and will count to above 30 MHz. The readout is in decimal form, using 7 segment incandescent Minitron display.

Devices used for the digital section of the counter are all SN7400 series. Data sheets on these integrated circuits are available from many of the suppliers, such as Poly Paks, Solid State Systems, etc. A careful reading of the data sheet will reveal there is nothing mysterious or even hard to understand about the operation of these digital counting ICs.

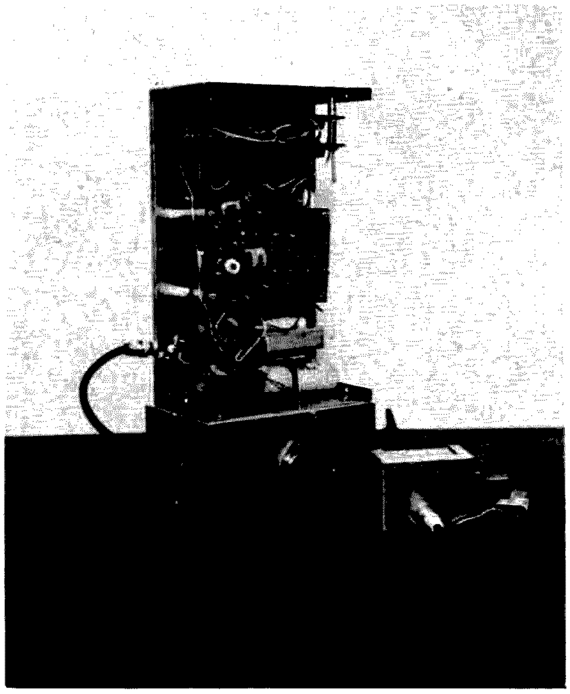
These IC devices are analogous to building blocks. All that has to be done is to connect these blocks correctly to build a counter. There is no interface problem between the blocks. There is a slight interface problem where the signal to be counted enters the first 7400 device. For instance, the 7490 will operate with either sine or square wave, but if the input of the 7490 is left open, it will drift up; the device will lock up and refuse to switch if the signal is coupled through a capacitor. Since capacitor coupling is often desired, a resistor can be connected from the input pin to ground to keep the input from drifting up and locking.

A resistor of several hundred ohms will correct the lock up condition and allow switching, but it was experimentally determined that a biasing network was a better solution. If the input is held at about 1.2V, a signal which swings symmetrically about this point will be counted with a minimum of wasted voltage swing. This does lower input resistance, but this is a minor inconvenience. It was thought that the IC might be confused about whether it was at a logical 1 (up) or 0 (down). This has not been a problem.

The disadvantage of feeding the IC chain directly is the low input impedance inherent in the method. A better method is described later in this report.

Frequency Measurement

Consider a 1 MHz sine wave, symmetric about a zero axis. Each cycle will have ½ T in the positive direction and ½ T in the negative direction, where T is the period and is 1/F. In exactly one second, 10^6 cycles will occur.



When built entirely of small sub-assemblies, a compact unit can be designed that will fit the most limited available space.

It is obvious that two things are required. The one second must be known to a high degree of accuracy and something must be available to detect (count) each of these micro-second intervals. The latter problem is simplified because each period is similar to the others and there is one positive excursion and one negative excursion during each period.

The 7490 will count this signal or any signal within its frequency range provided the negative part of the signal holds the 7490 input pin at less than .8V for at least 50 nano-seconds. The typical upper frequency limit of the 7490 is 18 MHz. Selection of the first 7490 will raise the frequency limit since some 7490's will switch faster than others.

Counter

A highly accurate timing signal is obtained by dividing down a 1 MHz signal from a frequency standard. The clock (Fig. 1) begins with a crystal oscillator which uses two cross-connected gates as active elements. This signal is divided to whatever frequency is desired. The frequency is selected by a switch which feeds the gating circuit (Fig.

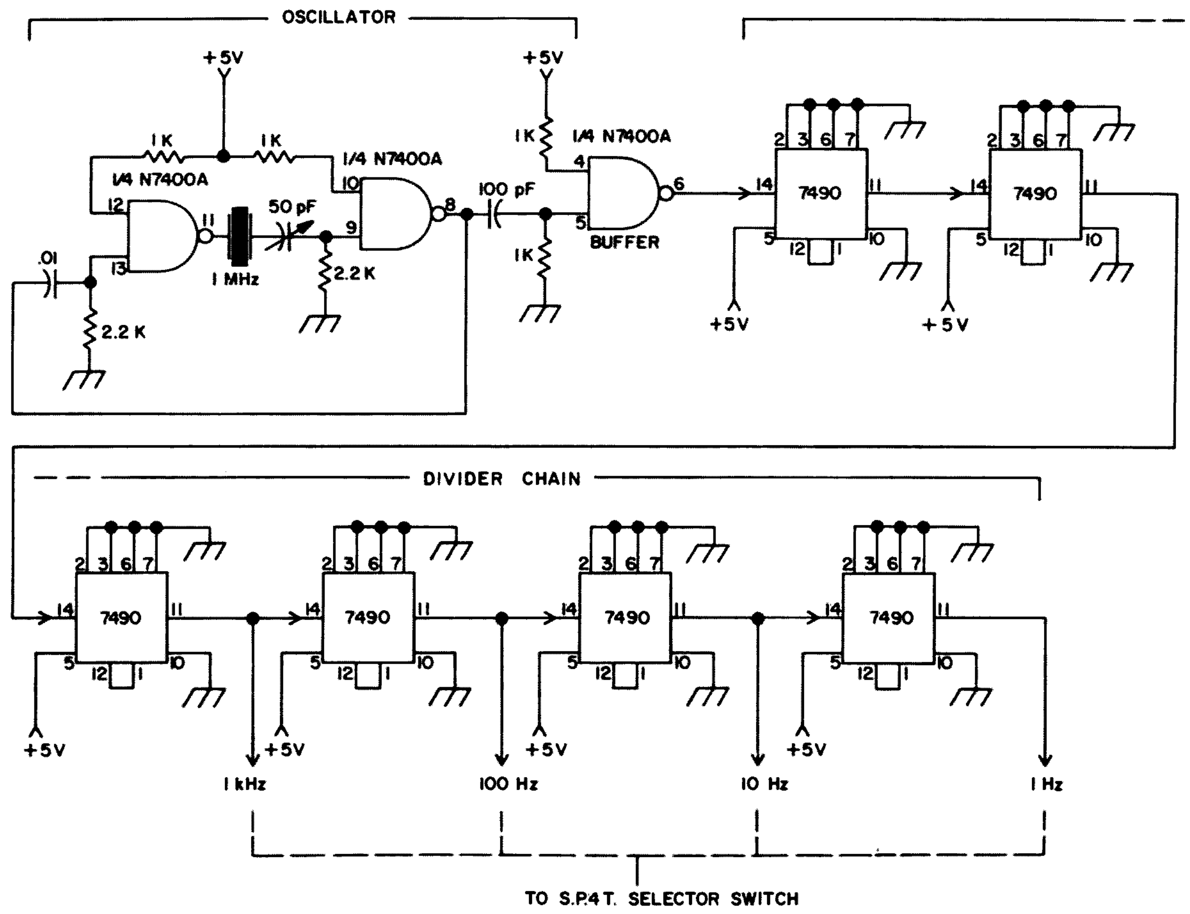


Fig. 1. The clock generates an accurate timing signal of 1 second, .1 second, .01 second or .001 second.

4). The signal coming from either of the clock outputs is a square wave, having an up or positive time of ½(1/F). (This assumes symmetric division, which is not necessary but is easier to understand.) This square wave goes up to the 7493 which counts to 16, overflows, and counts to 16, over and over. *The time this IC remains in any one count is 2(½)(1/F).*

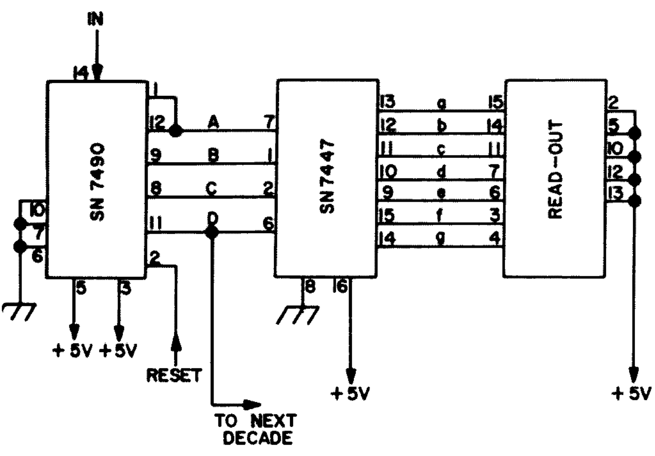


Fig. 2. This is the basic counting unit. It counts, decodes, and displays one digit. Four are required for 4 digit readout.

When a count of 15 is reached a NAND gate detects the state and switches pins 2 and 3 of the first 7490 to ground enabling the 7490 to begin counting. The following 7490's are set up to count at this time and so the count chain (Fig. 2) operates. When the 7493 leaves count 15, the NAND gate switches pins 2 and 3 of the first 7490 high and the count stops.

Since the four displayed decades have not reached a reset pulse and no pulses are coming in, the display stays up. The 7493 is still counting, having started over after 15 and when a count of 14 is reached the 3 other NAND gates reset the 4 displayed decades. At 15, the cycle repeats.

Since 1 MHz is a 7 digit number, seven 7490's, seven 7447 decoder/drivers, and seven readouts would be required to count and display all 7 digits. The last 7490 in the

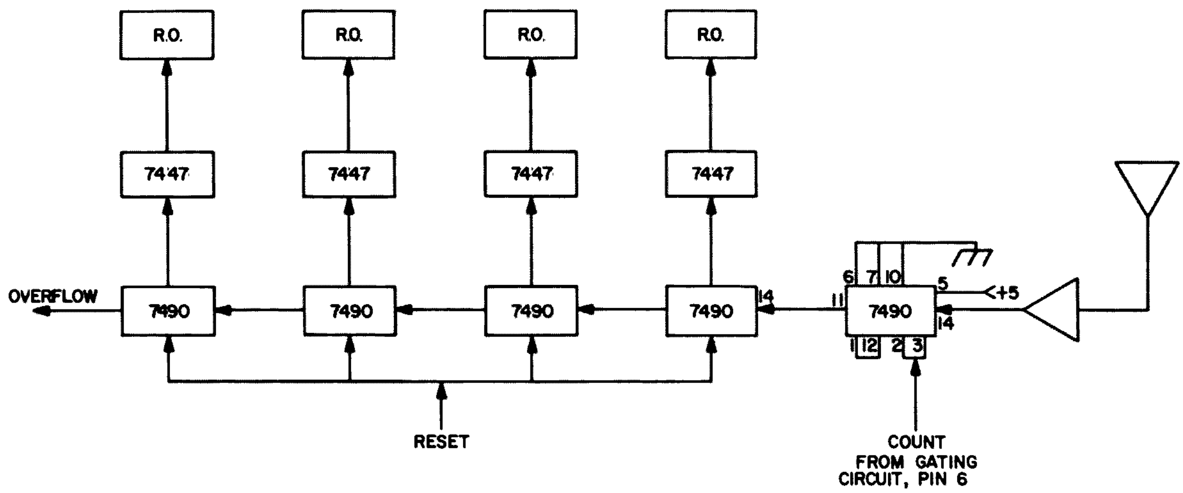


Fig. 3. Block diagram of 4 digit counter.

chain would contain the most significant digit (MSD), a 1. The input 7490 would contain the least significant digit (LSD), a 0.

However, if the counting period is divided by a factor of 10, the number to be displayed will also be divided by 10. The LSD has been eliminated, and 6 decades would be required to display all cycles counted.

In the same manner, if the count period is (1/1000) second, number of cycles will also be (1/1000) Frequency and the 4 digits displayed will be the most significant digits. Also, if only 4 digits are displayed and count time is 1 second and signal counted is 1 MHz, the counter will overflow and the 4 digits displayed will be the least significant.

By combining these operations, 4 digits can read out each digit of any signal within the range of the counter. Four digit readout (Fig. 3) appears to be a good compromise between cost and ease of operation. If the LSD is never desired, it is not necessary to provide a decoder/driver or readout for that digit. This saves the cost of the parts eliminated, and has the added advantage of increasing the upper frequency limit of the counter, since switching speed is partly a function of load on the IC.

For fast gate times the display appears to stand still, and will appear to 'track' a vfo. At the slowest gate time, the cycle takes 16 seconds. Since the primary use of the counter will be for MHz signals and resolution to the nearest kHz is usually sufficient, this is no problem. Another arrangement would be desired by a piano tuner.

The counter requires a good 4.75V to 5.25V supply. It is hard to damage the 7400 series if overvoltage is avoided, but at least one 7490 has been destroyed by a momentary supply voltage of 7V.

The supply described does a very good job (Fig. 5).

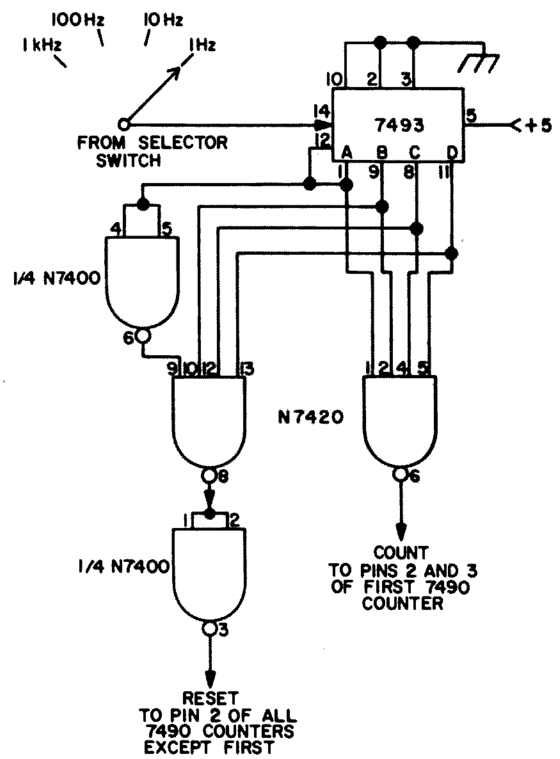


Fig. 4. Gating circuit controls count, reset, and display.

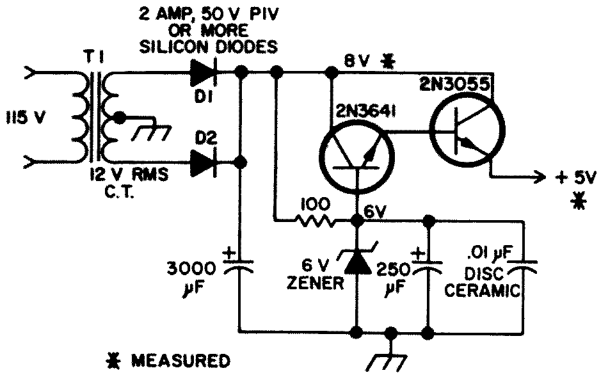


Fig. 5. 5V supply. This supply feeds all IC devices plus incandescent readouts.

5V Power Supply

The 5V supply uses a Darlington connected emitter follower. Maximum current drain of the counter was calculated for worst case conditions and it was found to be approximately 1.3A. The 2N3055 will pass this easily.

Zero output resistance is desired, so that V_O will be constant with varying load current. Actual R_O is approximately .04Ω.

Output voltage will be Zener referenced voltage minus two base emitter drops. Zener was chosen to be 6V, 1W. Zener current= $(20\text{-}i_b)$mA. Zener dissipation will not exceed 6 (.02)W, which gives a good safety margin.

This is a reasonably small percentage of 20 mA, the maximum Zener current. Both transistors are operating well within power, voltage and current limits. Unregulated voltage comes from a center tapped full wave rectifier. The capacitive filter gives 8V from a 6.3V rms transformer secondary. The 5V supply is shown in Fig. 5.

Input Amplifier

The input amplifier is shown in Fig. 6. The MFE 3007 is a MOSFET having relatively high input resistance. It drives a direct coupled 2N3641 follower which gives power gain and impedance transformation.

From the data sheet, R_L=2.5 KΩ. A resistor of 2.7 KΩ was selected. If drain current is chosen to be approximately 5 mA, about 13.5V will drop across R_L. It is desired to have about the same voltage drop across the transistor and this indicates a power supply voltage of at least 27V.

The bias network was determined experimentally, working from approximations obtained from the data sheet. The MOSFET is operating somewhat above voltage ratings on signal swings. Drain voltage maximum is 25V, while supply voltage is 35V, so bias was adjusted carefully to keep the device out of the high voltage region for extended periods. No ill effects have been observed due to the over-voltage. Output resistance of the MOSFET is taken to be approximately equal to the drain load resistor.

Output resistance of the emitter follower is about 50Ω. The 2N3641 is within all tolerances.

The resistor diode network at the output of the 2N3641 sets input conditions for the first 7490. The diodes conduct when signal input exceeds back bias plus the forward silicon junction drop. This prevents burnout of the 7490 which otherwise might occur.

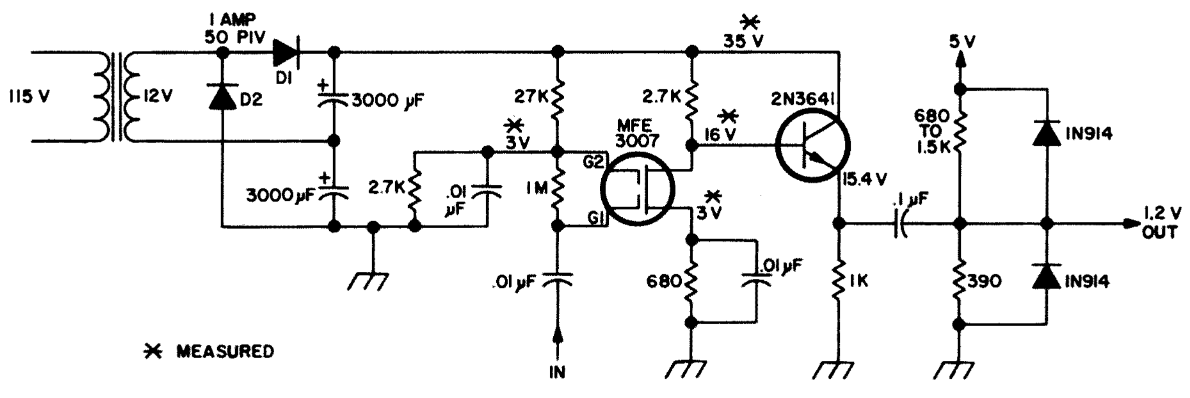
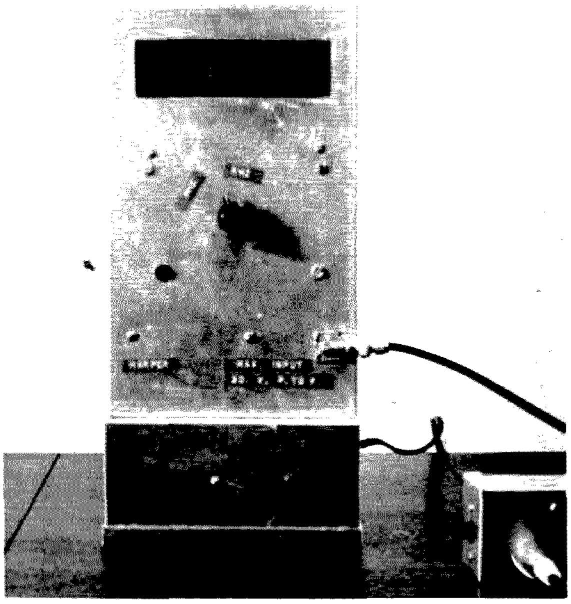


Fig. 6. Input circuit. Signal to be counted comes first to this circuit, where it is amplified, clipped, and fed to input of first 7490.



The main 5V power supply is mounted in the box that serves as the base for the unit. The input amplifier board and its power supply are mounted above that and all other circuitry leads up towards the read-outs at the top.

The input amplifier power supply is a common voltage doubler. Ripple is about .1V.

The original model which was built from the schematics in this article will count reliably to above 37 MHz. The crystal oscillator can be zero beat to WWV to get a highly accurate timing signal. Accuracy of displayed count, of course, is directly related to accuracy of the clock. For all known frequencies measured, counter error has not been visible, that is, the undisplayed digit contained whatever error existed.

For instance, the color TV chrominance subcarrier frequency is phase locked to the network frequency standard which is highly accurate. This frequency is 3.579545 MHz. The counter displays 3.57954 with the LSD not displayed, as usual.

A counter is one of the most useful pieces of gear you can have around a ham shack. The total cost for the basic counter excluding power supply and input amplifier was $33, and at this price there's hardly an excuse not to have one.

. . .Harper

Doug Pongrance WA3JBN
316 Donnell Road
Lower Burrell, PA 15068

VOM DESIGN

Convert that spare meter into a useful test instrument.

Many hams don't have a VOM in the shack and probably have run into more than one instance where they could use one. Well, here's how to get one for a fairly cheap price and learn something too.

The most expensive part of a VOM (if bought new) is the meter movement. If one is available in the junk box, good, but the next best place would be the ham fest. What to look for is the most sensitive (lowest ma at full scale) milli-or micro-amp meter. A 500 μa will do very nicely, but anything up to about 10 ma will do.

After obtaining a meter, measure its internal resistance using the resistance scale of a friends VOM.

For voltage measurement, resistors are wired in series with the meter to obtain different voltage scales. Decide what voltage scales you would like and see Fig. 1 for computing series resistor values. It is shown using 1, 5, 10, 50, 100 and 500 volt scales. Notice that none of the series resistors are standard values, but two or more resistors could be wired in series to obtain the proper value. To enable the meter to measure ac in addition to dc a rectifier and capacitor must also be wired into the circuit. Fig. 2 shows the ac - dc volt meter.

For the addition of current scales different resistors must be wired in parallel with the meter. For a scale two times that of the meter, a resistor, equal to the meter's internal resistance, is wired in parallel so that ½ of the current goes through the meter and ½ through the resistor. For a scale three times that of the meter two resistors are wired across the meter so that 1/3 of the current goes through the meter and 2/3 through the resistors. The number of parallel resistors that are equal to the internal resistance is found in the following formula (A+B) - 1 where A equals the desired current scale in ma and B equals the full scale current reading of the meter. The parallel resistors for any one scale can be combined into one by using Ohms law for parallel resistance: Example:

I want 500 μa, 1 ma, 10 ma, and 010 ma current scales using a 500 μa 150 Ω meter. For the 500 μa scale no resistor is needed. For the 1 ma scale one 150 Ω resistor is used. For the 10 ma scale 19-150 Ω resistors are used in parallel which is equal to about 7.9 Ω. Two 16 Ω resistors in parallel could be used. For

Desired Voltage Scale	Current Rating of Meter in Amps	Necessary Resistance	Internal Resistance of Meter	Series Resistor
1	.0005	2000Ω	150Ω	1850
5	.0005	10K	150Ω	9850
10	,0005	20K	150Ω	19850
50	.0005	100K	150Ω	99850
100	.0005	200K	150Ω	199850
500	.0005	1 meg.	150Ω	999850

Fig. 1. Table of resistor values for VOM.

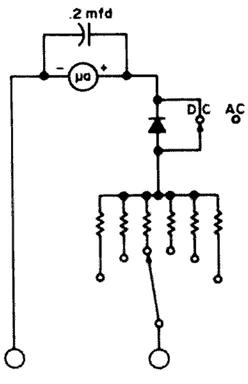


Fig. 2. Ac-dc voltmeter.

the 100 ma scale 199-150 Ω resistors are needed, equal to about .85 Ω. Just use two .43 Ω resistors in series.

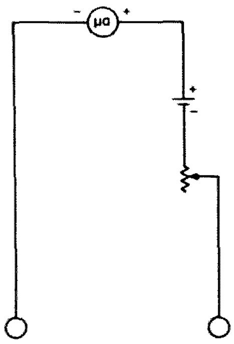


Fig. 3. Basic circuit for ohm-meter.

The next step is ohms scale. Fig. 3 shows the basic circuit for an ohm-meter. Calibration of the ohms scale will have to be found experimentally. Different values of resistors should be tested in the circuit to obtain approximate calibration. In my circuit using a 500 μa 150 Ω meter indicated about 100K at little deflection of the meter and about 1K at mid-scale.

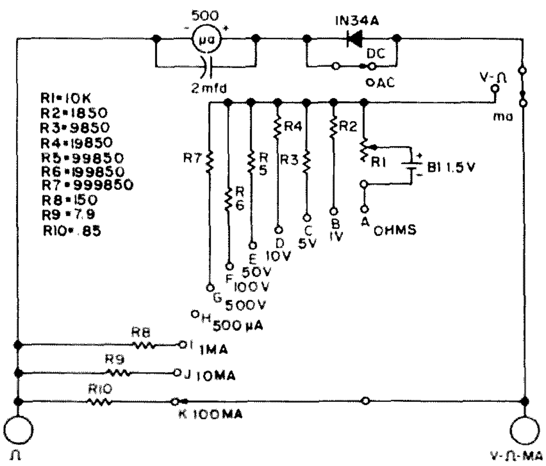


Fig. 4. Circuit for combined VOM with a 500 μa 150Ω meter.

Fig. 4 is the circuit for the combined volt-ohm-milliampmeter using a 500 μa 150 Ω meter. Five or ten % resistors can be used but 1% are better if they are available at a low price.

The VOM I built cost me about two dollars and works fine.

. . .WA3JBN

Clifford Klinert WB6BIH
520 Division Street
National City CA 92050

SIMPLE QRP TRANSMITTER

This article will describe a two transistor transmitter that is not difficult to build, and can supply up to one watt rf output for the QRP or portable sportsmen. The transistors are not excessively priced and are very reliable even though operated beyond their ratings. The use of an unusual type of keying provides chirpless keying with a negligible backwave. The transmitter operates from a 12 volt source making a car battery or lantern batteries ideal for portable use. With this configuration, tuning is not critical and the transmitter is completely stable. The output tank circuit is relatively inefficient but provides good selectivity and is simple to tune and construct.

The Circuit

The schematic is shown in Fig. 1. This is just about as simple as a transmitter can be made to provide this type of performance. Q1 is the oscillator transistor. This oscillator circuit was designed by trial and error for simplicity and reliability. Keying, however, is very poor. If the final, Q2, is only keyed by turning the B+ on and off, the signal from the oscillator will feed through the transistor. This is an inevitable result of the basic characteristics of the transistor, and the rf path must be broken. The obvious way to do this is to key the signal from L1 to Q2. This completely eliminates the backwave and chirp problem.

The final stage is operated as a straight through amplifier. A resistor and bypass conductor might be added to the emitter to bias it farther into class C, but this would of course add extra components and reduce the simplicity.

The tank coil, L3, is link coupled to the antenna and Q2 by fixed link coupling. The small number of turns on L2 and L4 allow L3 to have a higher impedance for better selectivity. The antenna and transistor have a lower impedance that is the source of many of the matching and tuning problems in transistor transmitters.

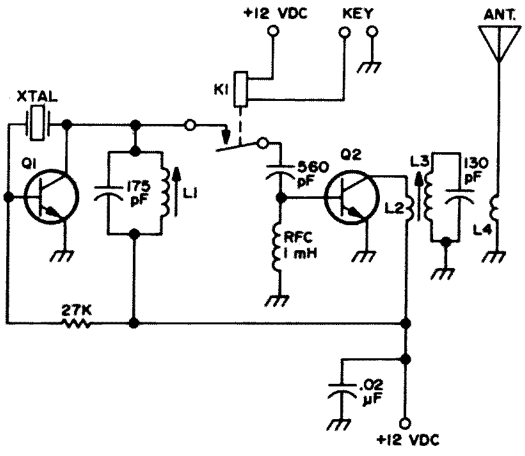


Fig. 1. Schematic

XTAL	7 MHz fundamental
Q1	40080
Q2	40081
L1	20 turns No. 28 on ¼" dia. slug tuned form
L2, L4	5 turns No. 24 on L3
L3	28 turns No. 28 on ¼" dia. slug tuned form
K1	sensitive spst relay for 12V (see text)

Comments:

The resistor is 1/2 watt carbon, capacitors can be disc ceramic or mica, and heat sinks must be used on both Q1 and Q2.

Construction

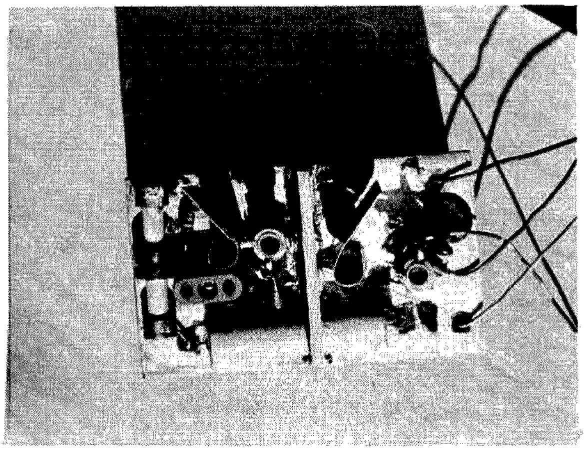
The transmitter was built on 1/8" thick double clad printed circuit board. Figure 2 shows the layout of the bottom of the board. The top of the board was left with the copper clad sheet on except in places where leads come through. This allows the copper on the top side to be used as a common ground connection that is easy to solder to anywhere on the top of the board. This double clad board is also very mechanically rigid and leaving the copper on provides a means of structural connections by soldering.

The only unusual component is the relay, K1. This is a sensitive reed relay that is ideal for this purpose. The current for the coil is only a few percent of the total current that the transmitter draws. Other types are available in the catalogs, and the only major requirements are compatible size, low coil current, and fast switching. Good quality contacts are also necessary to minimize clicks.

The board can be processed by the methods outlined in any good printed circuit board kit, or the builder may wish to use his own methods. An easy method is to use paint as the resist and obtain Ferric Chloride from a chemical supply house for the etchant. The paint can be applied with a small brush where the conductor is to remain. The parts to be used should be kept handy to check for size and position. Clean the copper before applying the resist by rubbing with steel wool. Keep the steel wool away from any electrical equipment. During etching, the etchant and board are placed in a shallow pan or tray. The solution must be kept warm to hasten the chemical reaction. This can be done with a heat lamp or very carefully on a stove. A beginner should start with a good kit and develop his own methods after a little experience.

The capacitors are soldered directly on to the coils and are placed wherever the shortest leads will result. Components are soldered in with little trouble, and placement and layout are not critical.

The transistors must have heat sinks because of the power that must be dissipated. Since there is little room for the commercial type heat sinks with radial fins, homebrew heat sinks had to be made. They can be simply bent from copper as seen in the pictures. Use a copper that is stiff enough to retain a good grip on the transistor case. Silicon grease could be used to provide a good thermal contact, but this has not been necessary. If the transmitter is to be used in dark surroundings (inside a cabinet) the heat sinks can be painted black



WB6BIH QRP transmitter.

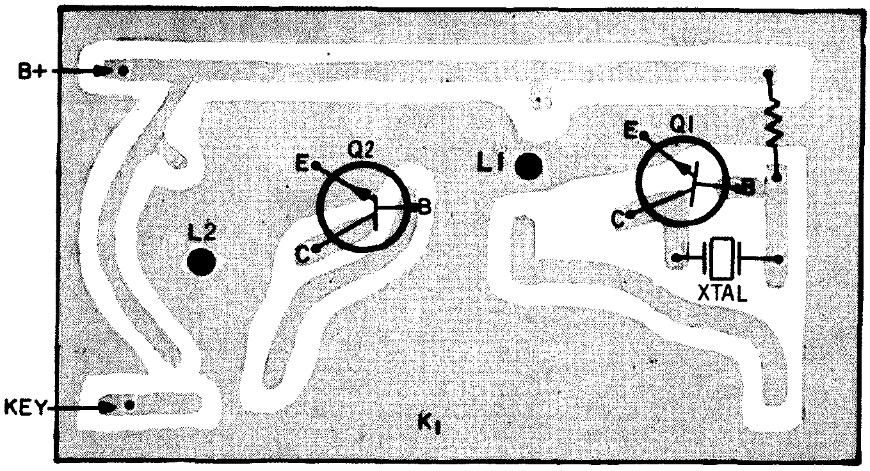


Fig. 2. Printed circuit board. Layout is not critical, this is merely a suggestion.

to increase heat radiation. If they are in the sun, they will absorb the heat, of course.

The construction of this unit is not complete as shown in the pictures. Sides and ends will be added and the unit will be installed in a cabinet with batteries for portable operation. I'm sure that each builder has different ideas of what he wants to build.

Results

The tests conducted on the final version showed tuneup to be non-critical on the oscillator. Oscillation will result with the slug of L1 in almost any position, but there is a point that will produce maximum stability. Adjust the slug of L1 while keying the final to check the loading effects of the final on oscillator stability. When the oscillator is oscillating the oscillator current will be considerably smaller than the non-oscillating condition. The oscillator can be tuned for a dip in collector current, but it will be necessary to detune from the dip to provide optimum stability. There is plenty of output from the oscillator to drive the final. The amount of drive to the final can be estimated by the amount of final collector current. Tune for maximum final collector current with good stability. The tuning of the final tank coil should produce a sharp peak when tuned through resonance. The link coupling was designed experimentally for optimum power transfer to a 50Ω load. Other final tank circuits provided more output but this circuit was easiest to tune and provided good selectivity against harmonics.

While tuning avoid prolonged key down periods because the transistors can become overheated in a few minutes. In a test, the input to the final was about three watts with output about one watt. This means that the transistor must dissipate the remaining two watts into the air, which is the maximum power dissipation rating of this transistor with a good heat sink. The use of CW allows the transistor to cool during key up periods but the transistor will still run quite warm.

A listen to the keying shows it to be quite sharp and free from chirp. A look at the scope pattern confirms this and the keying tends to be "clicky." This has not been a serious problem, however, and the simplicity of design and freedom from chirp makes it an acceptable compromise.

This transmitter will make an amusing weekend project for the builder with average experience, and QRP is an increasingly popular sport. Forty meter CW is very popular with a frequency of 7040 kHz, most popular for QRP use. This is a portion of our hobby with unlimited challenge. Contacts of thousands of miles have been established with much less than a watt, and one million miles per watt can be achieved with microwatt transmitters over short distances. Anyone can buy a kilowatt and work the world, but doing it with milliwatts is a personal achievement that can provide real satisfaction.

WB6BIH

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THE NUMBERS GAME: DISTRIBUTION OF DXCC HOLDERS

When I received DXCC Certificate No. 12,189 on July 22, 1971, several questions occurred to me concerning the history of this award, how many DXCC members are in each of the 10 U.S. call districts, how many certificates have been awarded to amateurs in various foreign countries, how many countries does the "average" DXCC-holder have credited, and so forth. Then with the arrival of the December QST it became apparent that I could get the answers to some of these questions if I were willing to devote some time (and eyestrain) to counting the calls in various categories of the Annual DXCC List printed on pages 95–100 of that issue. True, the annual list contains just slightly under 20% of the total number of certificates awarded, but it is felt that the sampling is sufficiently large to at least indicate current trends.

Table I
Number of DXCC Members by Number of Countries Confirmed (in Increments of 25 Countries and 50 Countries).

NO. COUNTRIES CONFIRMED	NO. DXCC HOLDERS	NO. DXCC HOLDERS
100-125	1,062	1,396
126-150	334	
151-175	297	562
176-200	265	
201-225	277	464
226-250	187	
251-275	215	450
276-300	235	
301-325	277	589
326-350	312	
TOTALS	3,461	3,461

Before commenting on the results of my curiosity, let me hasten to make the following disclaimers:

1. No guarantee is made as to the accuracy of any of the numbers presented. Counting and addition errors are certain to have been committed. Each column and page was totalled individually so the errors made should not be too gross (say less than 10 calls), but certainly small errors do exist, and possibly some of greater magnitude. The reader is invited to check any of the categories he is interested in, or to extract data for other groupings.
2. No conclusions are intended or implied from the data; particularly no *valid* con-

Table II
The number of DXCC-holders in each continental United States call district and also the number of 2-letter call members.

U.S. CALL DISTRICT	NO. DXCC MEMBERS	PERCENT OF U.S. TOTAL
2	340	15.8
4	300	13.9
6	278	12.9
9	240	11.1
8	201	9.3
3	187	8.7
1	182	8.4
5	168	7.8
10	163	7.5
7	99	4.6
TOTAL U.S. MEMBERS	2,158	100.0
NO. 2-LETTER CALL MEMBERS	332	15.4
MEDIAN NUMBER OF CONFIRMED COUNTRIES OF DXCC MEMBERS — 180		

Table III
Number of DXCC Members in Six Foreign Countries

COUNTRY	NO. DXCC MEMBERS	PERCENT OF TOTAL
Germany	222	6.4
Canada	121	3.5
Japan	114	3.3
U.S.S.R.	76	2.2
England	62	1.8
Brazil	49	1.4
TOTALS	644	18.6

clusions are possible as to the "best" or "most active" DX area. The number of DXCC certificate holders in any given area may be one "yardstick" to be used in settling this hotly debated question, but obviously many, many other factors would have to be considered, among them the distribution of the entire amateur population, the average age of DX amateurs in the localities in question (retirees have more time for DXing), geographic, political, and language barriers, legal restrictions on power in some countries, time zone disparities, economic affluence, etc., etc., etc., ad infinitum.

3. Time did not permit counting DXCC totals for every country (approximately 12–15 hours were spent at this task at odd moments). Hence, some countries with a significant number of DXCC-holders are not listed in the results.

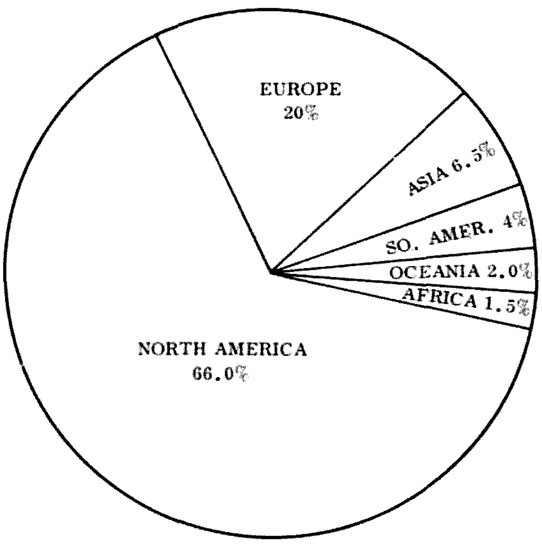

Fig. 1. In pie-chart form the approximate percentages of DXCC members by continental area.

Now on to the results. The first part of the job was to count the total number of calls listed in the general listing on pages 95–98 (mixed CW and phone – sorry, no results for phone-only listing). My count was 3,461. Next, I determined that the median point (1,730) fell in the grouping of 180 countries confirmed. Therefore, half of the DXCC members have less than this number of countries, and half have more. Since the columns on each page were counted individually, it was relatively simple to arrive at the number of DXCC members by numbers of countries confirmed. Table I shows these results in increments of 25 countries and 50 countries. The right-hand column of this table provided my first surprise result. As expected, the number of members decreases in a rather normal progression as you read down this column, until the last entry, where you find that 589 DXers have more than 325 countries credited, a sub-group exceeded only by the sub-group of members who have 100–150 countries confirmed.

. . .WA9VGS

Editor's Note:

Distribution of Licenses

According to the Callbook the distribution of amateur licenses falls about in this proportion:

Call District	Percentage
1	7.4%
2	12.5%
3	7.5%
4	13.4%
5	9.4%
6	14.2%
7	7.0%
8	10.2%
9	9.4%
Ø	9.0%

Thus there would seem to be some slight advantage to operating from certain parts of the country, if we assume that approximately the same number of amateurs will be devoted to DXing in all parts of the country. The number of DXCC winners is higher than the overall percentage of amateurs in the W2-W9-W4 areas, while it is less in the W7-WØ-W5 areas.

SOLID STATE EXCITER FOR 450MHz

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Working at 450 is not difficult if you know the techniques . . .

The UHF bands of 432 and 1296 MHz appear due for a large change and advance from now on as concerns portability, size, and usage. The availability of plastic transistors that work up in the 1296 MHz region, tenth watt resistors, small coils, crystals, and terminals, make construction of complete crystal controlled exciters possible in a 5 x 10 cm minibox with room left over for two 9V batteries!

This concerns such a unit, using doubling in all the multiplier stages. A comparison is also made with a similar unit which used tripling instead of doubling. Be sure to check on the final results as outlined later here. It may save you lots of time on such units.

Tools and Accessories

For the construction of a crystal exciter of this small size, there are certain things you should collect before you start. Without them you will lose time improvising and will not have such a compact unit.

A good, small iron. For some reason or other, the American Beauty iron people have been able to make an iron that you can leave on all day for years and years without having it burn out. I don't know how they do it, but some day I hope to visit them and find out. Just a hint: I have a 250 watter for large work, and a little one for small work such as 80–90% of the soldering done on this exciter. You have to have small solder too, of course. Keep a stock of small copper tips on hand and several files to shape the tips as needed. You'll see why when you tackle the small terminals.

Other small tools. If I may make some suggestions – two pair of tweezers, one flat, one pointed; the smallest sidecutters and needlenosed pliers you can get; a steel scriber; a set of No. 60 to 80 drills, with maybe some extra ones around No. 75 and 76; "coffee stirrers," which are just flat pieces of wood 7 mm wide by 10 cm long by 2 mm thick, with a pointed lump of wax (high-Q high temperature coil wax, that is) on the end for holding windings on the coils (use it like cement); several solid insulating rods of lucite and/or bakelite, 3 and 6 mm for filing into insulated screwdriver blades and insulated picks; small 10¢ screwdrivers that you file down for scraping around pins, on copper, etc.; emery cloth and crocus cloth for polishing brass plate capacitor surfaces; Exacto knife for cutting holes in fiberglass sheet; dentists' tin shears for cutting small brass or copper pieces; a jeweller's saw and plenty of blades, umpteen teeth to the inch; and all the rest of the usual tools you may have around.

Another handy tool is a coffee-stick with a 3 mm square 1000 pF bypass capacitor cemented on the end with 3 mm leads. This is the last word for testing

working bypass capacitors. Take any bypassed terminal or brass plate used for bypassing and connect this test capacitor across it, just by pressure. You don't have to solder it. Do it with all power on and watch the rf power output meter. If it makes any difference when you add it to the existing bypass, that bypass is not right. Remember, it isn't only the *amount* of pF at 432 MHz, it is also the length of the leads, if any, and the shape and position of the components being bypassed.

Components, Including Terminals

Resistors are easy, but you've got to put in a stock of 1/8th or 1/10th watters if you want to do the best job on small units like this exciter. Not all of the HEP56 transistors are exactly alike, so you may have to trim up the emitter resistors in the final tests. Best to have some of each of the following, in ohms: 22, 33, 47, 100, 220, 330, 470, and in thousand ohms, 1, 2.2, 3.3, and 4.7. I haven't used anything above 4.7K in this unit so that should about do it for resistors.

Most of the capacitors are easy, but you should have a good stock of the small high K ceramic bypass capacitors like .001 or .005. These should be the real small ones, say 3 cm square. I also use a lot of the small dippped mica silvered type DM capacitors for coupling, in values of 1, 3, 5, 10, 15, and 30 pF. They seem to do the job very well for VHF/UHF. Some multiplier stages like to have a variable coupling capacitor, and then you should use a small circular, or mica, trimmer. So far, in the UHF region, the mica compression trimmers seem the best for tuning; they are thin, long and narrow, and do a good job. It is easy to tell which is maximum and which is minimum, unlike some rotary ceramics. Arco makes excellent trimmers that are good for UHF, but please, why not use nylon tuning screws? Values in pF of 1 to 12, and 2 to 25, are good.

Winding wire should be on hand, and phenolic forms of 3, 5 and 7 cm OD Wire sizes can be 22, 24, 28, 30, and 34, looking at the spools I use here. Double silk covered is best.

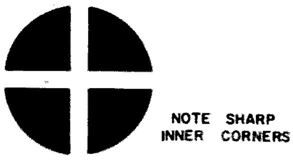

Fig. 2. Jeweller's drill chuck, holding end.

A good crystal holder is needed, too. I'm still using a monster crystal 2 cm long simply because it's here, but expect to go down a lot smaller in crystal size soon.

Various kinds of insulation materials are useful, such as small strips of linen-base bakelite 2 or 3 mm thick for terminal strip pin mounting, putting between the coils and the copper-clad baseboard, etc.

Terminals. Here's a really sticky one. I spent several hours on this item alone and did succeed in making an improvement. Instead of making up small individual little planks with three pins each, I made up the terminal strips as in Figs. 1A and 1B. It worked out excellently, and from now on that's it for me. Notice in Fig. 7 how everything goes together on those pins, three for each stage. I cemented the strip down, but for greater mechanical strength you can use 0-80 or 1-70 bolts if you wish,

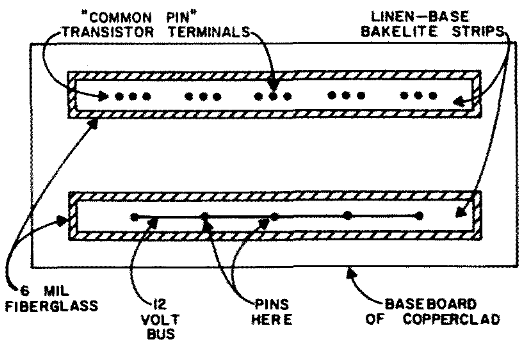

Fig. 1A. Terminal pin layout.

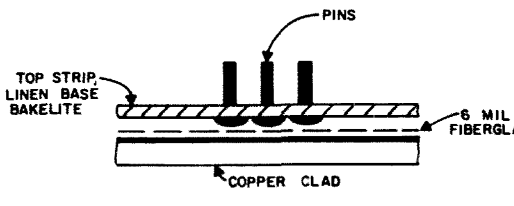

Fig. 1B.

which can be obtained from the better hobby stores. Also, note the 6 mil fiberglass under the strip to avoid shorting the pin terminals to ground. The terminals are just plain old common pins of nickel plated brass. I found some which are called "bank pins" which are really tiny. Drill the holes in the various terminal strips with a No. 76 drill. I use an old standard Black and Decker ¼ in. drill, in the less-than-$10 drill stand, a variac to slow it down, and a jeweller's chuck. The jaws of this chuck appear as shown in Fig. 2. You cannot, repeat *cannot*, use the cast, polished,

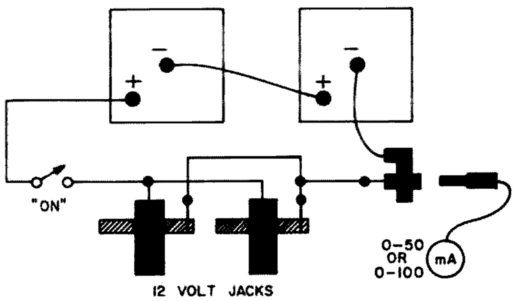

Fig. 3. Test battery detail.

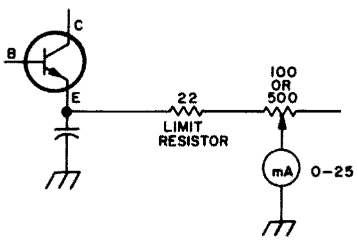

Fig. 4. Emitter resistor check.

chromed, and rounded jaws of some of the popular small drills. They won't close on a No. 76 drill! And you need slow speed too.

I also cut the pins in half, using a diagonal cut to leave a point on them, and then hammered them in through the strip. The final results are shown in Figs. 1A and 1B. They work! If you know how to make smaller ones than these, please let me know.

Figure 3 shows a handy bench type power supply using two lantern type batteries with 6W dc capacity, rated at .5A by the National Carbon Co. (Everready). This is a maximum, by the way, but will give you plenty of sock from a hill or mountain top with a good beam on 432 MHz.

Check the grounded terminals in your car so you can plug this unit in for mobile work if you wish. It is possible to arrange the baseboard to be isolated from the chassis (minibox) if you have to. The only rough part is the bypassing of the output connector. It can be done, though.

The meter business is not too complicated. As the oscillator stage and each doubler stage is built, connect in a meter as in Fig. 4. When this stage is tuned up and the current adjusted to what you want, solder in an emitter resistor of the proper value, and remove the meter and pot. Of course you can build the whole unit, connect it up, and have it work. Only you have to be lucky, and you won't learn as much.

Tuned Diode Power Monitors

If you've read at least half of my articles, you've met these before, and they are useful. Figure 5 shows a quickie on how they are made. Rf from the stage under test goes on a 50Ω cable to the diode unit. C2 provides some matching, C1 tunes L1, and C3 bypasses the rectified rf

and puts out dc to the test meter. This serves to: A) Tune up and check on the desired harmonic which in this case is always the second or doubling frequency; and B) Watch the power output. I have a series of these units here covering 2.3 to 10, 25 to 75, 112 to 216, 125 to 260, 160 to 475, 890 to 1320 MHz, and a coaxial one going from 350 to 1700 MHz. Also one for 1 to 12 GHz, but that one is a complete story in itself.

When you're down in the 1 to 50 mW region, things can be tough without a power meter, but power meters are relatively expensive. Here's how to get by. The usual diodes (good ones), tuned circuits, and meters, in the frequency range of 100–3000 MHz will produce about 5V dc into a 500 μA meter, with suitable resistors in series, using a box as shown in Fig. 5. At about this voltage a No. 48 or 49 bulb, which uses 2V at 60 mA, which looks like 120 mW, can be made to light with the rf on it. You have to match it carefully into the circuit, I might say, and maybe turn out the bench light in order to see that dull cherry red glow. Anytime I could light a bulb with rf in the last 40 years, I could work someone!

The Circuit

The final schematic, Fig. 6, and the parts layout, Fig. 7, are given now for clarity of reference in the following details. This circuit, using doubling multiplier stages only, was made up as a direct comparison to a three-transistor tripling

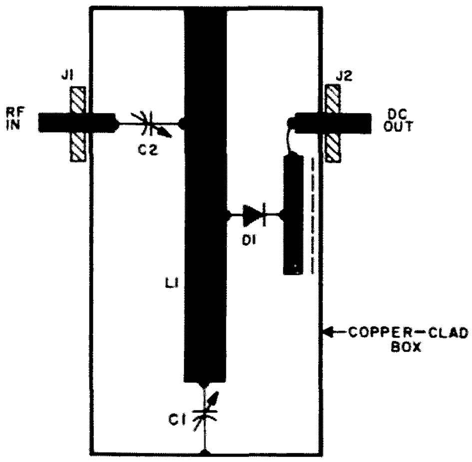

Fig. 5. Tuned detector. Box is 10 x 5 x 5 cm.

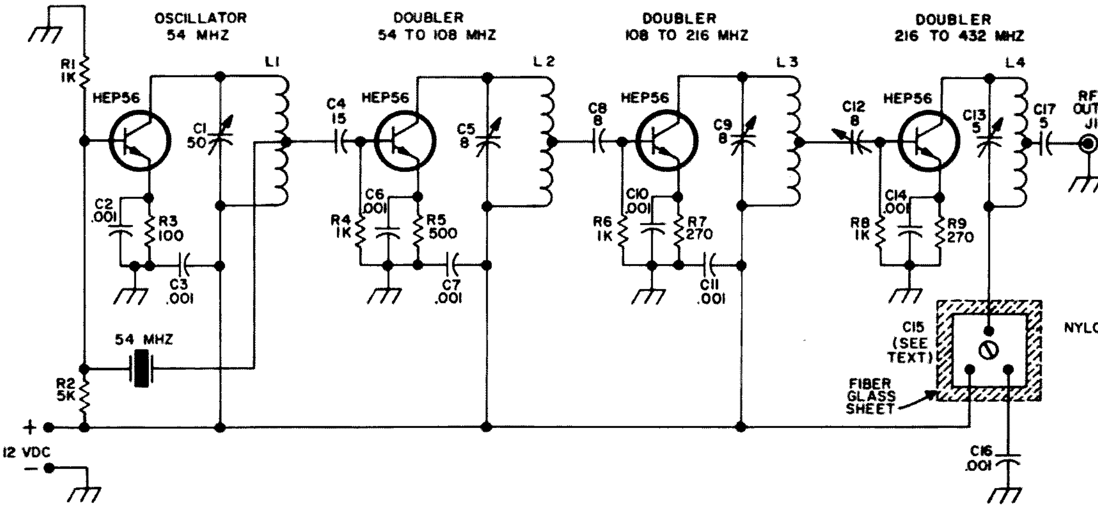

Fig. 6. Schematic. Transistors — All Motorola, HEP56, L2, 20 turns, centertapped, No. 26 DSC, on 5 mm OD phenolic, air core; L2, 10 turns on 5 mm form, No. 26; L3, 5 turns on 5 mm form, No. 28, about 1 cm long; L4, 3 turns, tinned bus wire, No. 18, about 1 cm long, tapped 1 turn from grounded (rf) end, 5 mm diameter.

exciter. The tripling exciter is a nice unit and it turns out to be excellent for a signal source, as a local oscillator, for calibration purposes, etc., but the fact remains that this doubling unit puts out more than four times the rf power at 432 MHz. This is somewhat to be expected as there are four transistors working on the job against only three in the tripling unit, but it was worthwhile to check them both in actual operation. It might be possible to put out more power with more expensive transistors, but this article describes a means of getting crystal control at 432 MHz which is *not* expensive. It fits in a little 5 x 10 cm minibox, and power amplifiers in the same size box have been built here and are being tested and tuned up.

The total current drain runs at only 25 to 30 mils at 12V, or less than .4W dc power, leaving another 5W battery capacity in those lantern jobs for amplifiers. So, on to the construction.

Construction

The stage-by-stage method is used here in order to get the most out of each transistor and at the same time check the possible variable parameters involved and to avoid marginal operation. The oscillator should start every time; the load on it should not be too large; the multipliers should tune nicely above and below the desired doubling frequency, etc. The emitter circuit current meter and the rf output connector can be shifted as each stage is finished, and checked for frequency and power output. Of course you can build the whole thing right off exactly as shown, and it *ought* to work. However, you might have more fun and learn more doing it stage by stage. Your choice entirely.

The oscillator was assembled and wired as in Fig. 8 and connected for tests. There is a small bakelite plank between L1 and the baseboard, and another one under the crystal socket, to keep the terminals from shorting out to ground. You have to take care in soldering those little pins, but you will be surprised after a few tries how strong they really are and how easily the whole assembly goes together. After all, if you want nice little camera-case rigs, this is what you have to do.

The base of each little pin is surrounded by insulation which keeps the wires and components from shorting to ground. The thin copper baseboard solders with a touch, and there is plenty of room for the few resistors and capacitors needed, and they all fit nicely in the layout as shown in Fig. 7. There is even room for another stage, which might be an rf power amplifier. There is only one wire on each of the three coupling capacitors that does not have a pin support, which is the centertap on the multiplier coils, and this holds up

one end of a silvered mica which I think is too light to shake loose. Purists for mechanical rigidity can put three pins on the planks under the coils if they wish.

I also use an external pot of 100 or 500Ω for the emitter resistor while tuning up, then when the desired value is found – which depends somewhat on the drive required for the next stage – R3 is soldered in place. This test setup is shown in Fig. 4.

LI and CI should resonate well above and well below 54 MHz. Do *not* rely solely on a grid dipper for this. Check it out as shown in Fig. 8.

You snould also listen to the carrier on a communications type receiver, not in the CW position, but with plenty of af gain so you can hear spurious, squegging, and other assorted squeaks and groans. These can easily be eliminated by proper tuning and bias, if you know they're present.

As CI is reduced toward resonance, the rf should increase to a maximum and then drop off with a snap. Back off slightly from resonance and find the position where it comes on every time and still has near maximum power output.

Trouble

This showed up, as usual. I might say in passing that these bugs are not of my invention. They are real, and I feel you should know about them. Some of these bugs have cost me as much as three days of rewiring and debugging time.

One I found was caused by connecting the output cable to the centertap of L1, and also the only 54 MHz crystal I had on hand was weak. The oscillator works perfectly with the alternate output connection shown in Fig. 8, and it also works very well when the centertap goes to the next base through C4, as in the final schematic shown in Fig. 6.

An interesting, unexpected and beneficial effect showed up with the weak crystal. When the unit was tested, using a good 53 MHz crystal I happened to have on hand, just for fun I tried out the weaker 54 MHz one. As a result of the excess gain of the three doubling stages, particularly the first two, the rf output was almost the same!

This oscillator shows good, stable rf power out of about 50 mW at 18 mA of collector current. Listening to it on my Ameco RE-5 transistor lab receiver, .5 to 54 MHz, it stayed in the passband (of the receiver) nicely, no matter how I tuned the oscillator.

Note that the base of Q1 is *in phase* with the collector except on the crystal frequency. The crystal reverses the phase and it then oscillates, but only on the crystal frequency. Anywhere else it is degenerative – that is, it has negative feedback. I have specified this circuit many

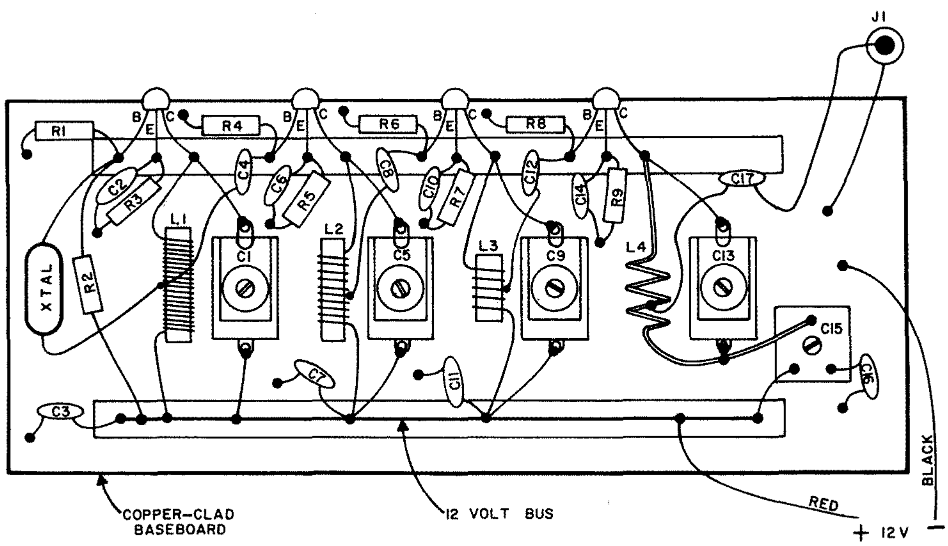

Fig. 7. Pictorial diagram and parts layout. Board size is 4 x 9 cm.

times, but feel it is a good thing to keep stressing it.

Doubler, 54 to 108 MHz

Refer to Figs. 6 and 7 for this one. This multiplier stage went together pretty well, although it proved a good thing that the 108 MHz doubling frequency was being monitored while tuning up L2 and C5. This doubling stage showed a lot more rf power output than the tripling stage mentioned. I obtained over 5V dc output from the tuned diode monitor, which is near 50 mW. The best I could ever do with the tripler was some 3V dc.

I wound two turns around L2 for an output coil for this test, then removed it later.

The emitter resistor check of Fig. 4 was also used here. The final value for best doubling to 108 MHz was 500Ω. Don't forget that different transistors, even of the same number and manufacturer, may require slightly different bias voltages, especially in harmonic multiplier service.

The tuning capacitor across L2, which is C5, was checked for a return to ground or a return to the low end of L2 and no difference was seen.

A choke coil was also substituted for the base resistor R4 and again no difference was noted, so the resistor was left in. An rfc here has caused trouble in the past with spurious oscillation under certain conditions.

Second Doubler, 108 to 216 MHz

This one went together like a charm with the only difference being C8, the coupling capacitor from the previous stage. This showed a preferred value of pF for maximum power out when a variable capacitor was used. A fixed one of 8 pF was installed as the best value. Not really critical, but it is good to have the best value.

The best emitter resistor value was found to be 270Ω for this stage. Again, a two turn coil was wrapped around L3 for an output check on 216 MHz, and was later removed. Again, 5V dc was found at the output of the diode monitor on 216 MHz. So, only one more doubler to go.

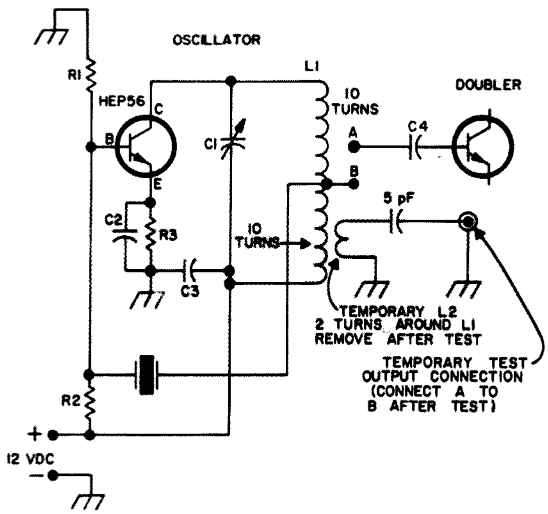

Fig. 8. Oscillator test detail.

Doubler, 216 to 432 MHz

Here I left the variable coupling capacitor in circuit because it peaked up the power output so nicely. Evidently this is a useful device for VHF/UHF multipliers. It probably has to do with matching the lowered base impedances as you go up in frequency. The best emitter resistor value checked out at 270Ω the same as the previous stage, with a collector current about 5 mA.

C15 is a brass plate bypass put in for security at 432 MHz. C16 was added also for a small improvement.

Various output taps on L4 were tried, with one turn from ground showing up as best. And there you are, on 432 MHz.

This complete crystal controlled exciter, fitting into a 5 x 10 cm minibox, using doublers, gives rf power output which is at least four times greater than the same type of unit using tripler stages. So, this one will be the new exciter for my battery portable rig on 432 MHz, and I can use the tripling unit for an LO, after tuning it up on 404 MHz, for use with a tunable 28 MHz i-f amplifier.

Of course, if you're starting in fresh, you might want to build two doubler type multipliers at the same time, tuning one to your LO frequency and the other to 432 MHz. That's up to you, and as for me, I'm working on rf power amplifiers for the band.

. . . K1CLL

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TALK POWER AND FM

Audio processing can hold your deviation to a socially acceptable level

Frequency modulation is capable of the highest quality of audio transmission of the known modulation systems and it is competitive with the best of them for communications effectiveness. At the same time, it is one of the more sensitive modes in respect to proper adjustment. Although it sounds paradoxical, it is possible to have "low audio" on a signal that is overdeviating.

"Talk power" for the purposes of this article will be defined as "high apparent loudness and intelligibility." Have you ever noticed how loud the modulation on some signals sounds compared with others? This disparity can exist despite the fact that signals at both extremes can have the same deviation setting.

Such differences between signals are attributable to the audio processing prior to the modulation process. A completely linear system would have broadcast quality, but it couldn't compete with a well-adjusted nonlinear processing system for communications effectiveness. Any attempt to increase talk power without nonlinear processing by increasing the deviation setting simply results in overdeviation.

Evils of Overmodulation – FM vs AM

In an AM signal, overmodulation causes flattened peaks on the detected audio at the receiving end of the system. To be sure, an overmodulated AM signal is undesirable because of sideband "splatter," but in moderate amounts it increases talk power due to clipping, as shown in Fig. 1. Because of the high peak-to-average ratio in the average voice waveform, clipping increases the talk power of the signal. In moderate amounts the resulting distortion isn't enough to offset the increase in loudness; thus an increase in communications effectiveness is achieved. Clipping and filtering systems are used in AM systems to exploit this advantage without generating sideband splatter. These systems work because the clipping process is accomplished at a point in the audio path where subsequent filtering can remove the higher-order distortion products prior to modulation. These higher-order products are responsible for the splatter generated without filtering. When clipping is left to the modulation process itself (overmodulating) no filtering action can take place. The point is that the receiver doesn't know the difference between a clipped and filtered signal and an overmodulated one. In either case,

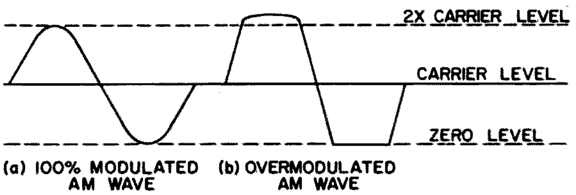


Fig. 1. Detected AM waveforms for a sinusoidal input.

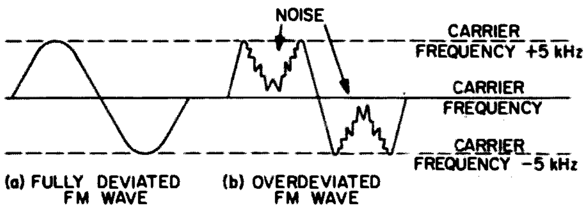


Fig. 2. Detected FM waveforms for a sinusoidal input.

talk power is higher than it is on an unclipped signal.

Such is not the case on FM. Compare the overdeviated signal of Fig. 2 to the overmodulated AM signal of Fig. 1. In contrast to the clipped AM waveform, the overdeviated FM signal sounds raspy and distorted. In fact, instead of sounding louder, the fundamental wave is decreased in amplitude and distortion products are vastly increased (see Fig. 3). The reason for this phenomenon is that the signal passes out of the receiver passband twice for each cycle of audio, once on the high side and once on the low. During the periods that the signal is "gone," the discriminator output produces receiver noise. Compounding the problem, the high-order distortion products so generated get into the squelch noise amplifier of the receiver, causing the squelch to "chop" on audio peaks.

There are two ways to keep overdeviation from occurring. One is simply to keep the audio applied to the modulator at a low enough level. This approach never works satisfactorily in amateur communications. Remember, most FM rigs have an effective processing system. When you receive a modulation report, it is a comparison against these systems. If you don't have nonlinear processing the report will always be "low audio," even if you overdeviate on peaks.

In all commercial FM services an automatic deviation-limiting system of some sort is required by the FCC. Primarily this requirement is to prevent the adjacent-channel interference overdeviation would produce, but such limiting has the further advantage to the user that it improves communications effectiveness when the limiter is put to work as an audio processor. As a deviation limiter the audio level is held to a low value so that only the occasional peak is clipped, but as an audio processor the level is pushed up so as to make the limiter work almost constantly.

Processing Process

The usual processing system is built around a clipper similar to those effective AM systems. A low-pass filter follows the clipper to remove the offending high-order harmonics generated in the clipper. FM systems go a step further in the addition of a pre-emphasis process before clipping. Pre-emphasis is the process whereby the high audio frequencies are amplified more than the lows at the transmitting end of a system. To prevent a "tinny" sound at the receiving end, the receiver demodulator has a de-emphasis circuit that restores the original frequency response. For commercial and amateur communications systems the standard pre-emphasis curve is 6 dB per octave bettwen 300 and 3000 Hz.

Pre-emphasis is based upon the fact that the average power in the higher frequency range of a human voice is much lower in amplitude than the lows. By pre-emphasizing

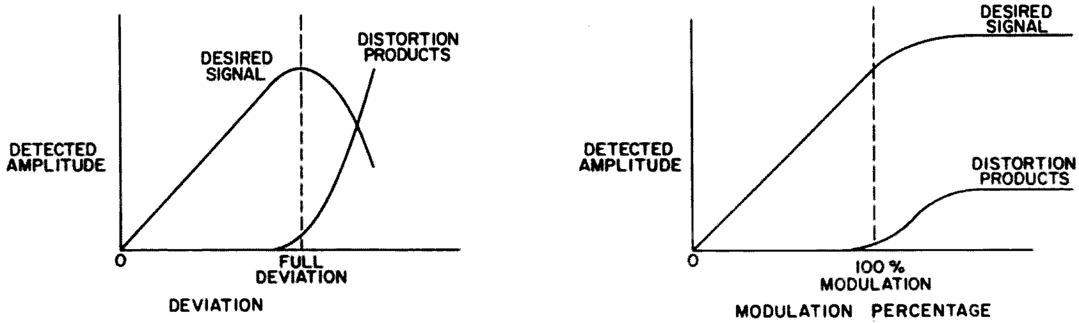
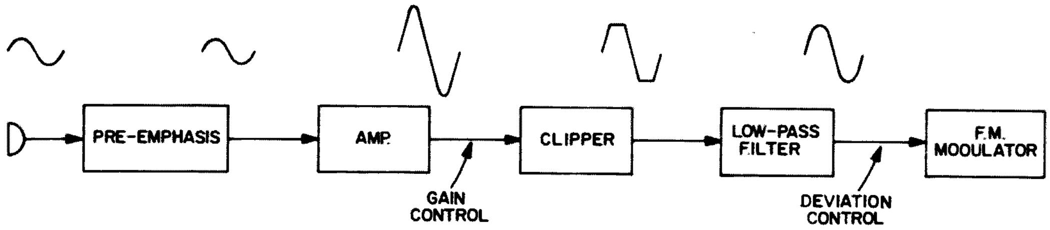
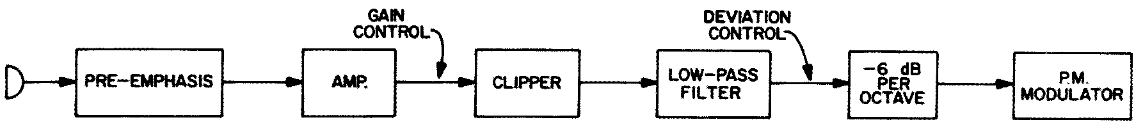


Fig. 3. When an AM signal overmodulates (right) there is no loss of response to the desired signal while distortion products increase only to a point. When an FM signal overdeviates (left) the desired signal response decays rapidly and distortion products increase drastically.



(a) Block diagram showing processing steps required in an FM transmitter.



(b) Processing steps for an FM transmitter utilizing a phase modulator.

Fig. 4. Sequence of processing for FM transmitters, showing the location of gain and deviation controls.

the highs they are raised in level further above whatever noise might be picked up en route to the receiver. When the highs are again de-emphasized to their original level, some of the noise is also de-emphasized with them.

Figure 4(a) shows the sequence of steps used in an FM processor. Pre-emphasis is applied early in the speech amplifier, often before the first amplifier stage, to prevent enhancement of any distortion products from the early amplifier stages by the network. The pre-emphasized signal is then clipped and passed through a low-pass filter to the modulator.

At the receiver the signal is recovered in the form of audio by the discriminator, de-emphasized to restore frequency response and amplified to drive a speaker. The only net changes in audio characteristics between the microphone and the loudspeaker are due to the clipper (plus any degradation due to incidental nonlinearities in circuits or noise picked up en route).

It is important to understand why the gain the deviation pots are located as shown. The deviation pot is between the clipper and modulator while the gain control can be located anywhere before the clipper. Figure 5 illustrates the effect of adjusting the deviation control. In (a) the clipped signal is set to less than 5 kHz deviation (a narrow-band system). Although the processing helps to offset the low deviation setting, this signal won't have the effectiveness of a fully-deviated signal, as shown in (b). Note that the clipping threshold is set just below the 5 kHz limit, preventing the signal from passing

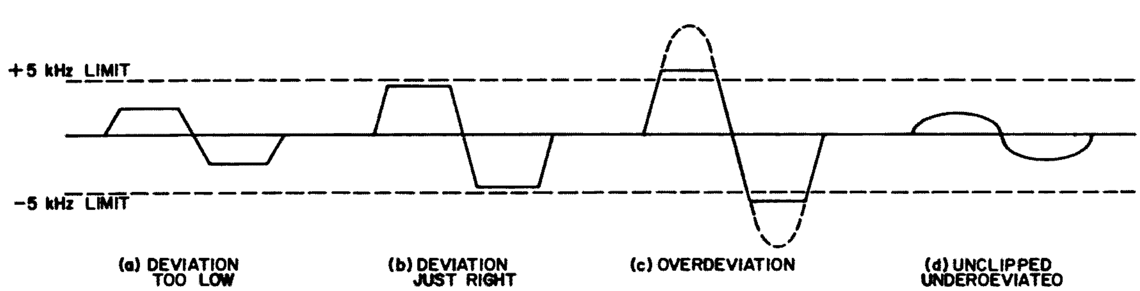


Fig. 5. Effect of deviation control on modulation. A clipped wave is shown to reveal the clipping threshold relative to the deviation level. Dotted lines on the overdeviated wave indicate waveform if unclipped.

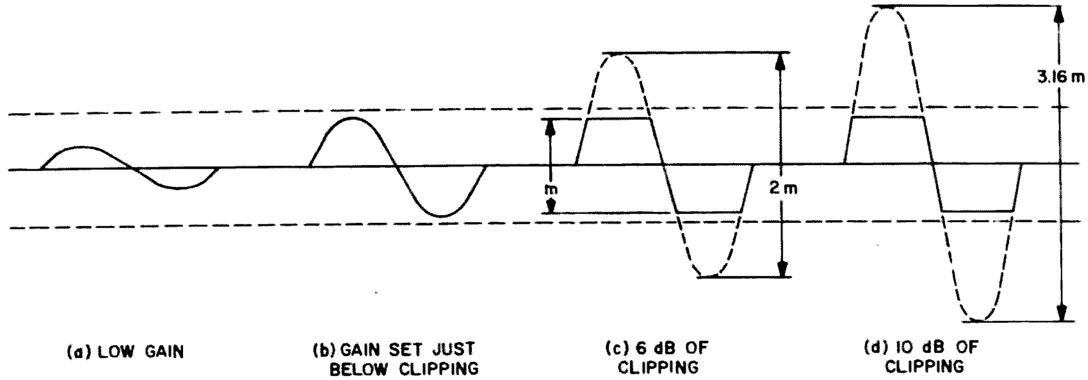


Fig. 6. Effect of gain control adjustment with deviation control properly set. Dotted lines on clipped waveforms indicate the amplitude of the waves if they were not clipped.

outside of the receiver i-f limits. An overdeviated adjustment is shown in Fig. 5(c). Note that the deviation is held down by clipping, but since it is just outside of the passband of the receiver on both sides it sounds the same as an unclipped, vastly overdeviated signal (illustrated by the dotted line waveform). The benefits of clipping are completely defeated on this signal. In Fig. 5(d) a low-deviation sine wave is shown. Can you tell where the deviation limit setting is for this signal? Of course not, because the limit is only visible when the signal is high enough to show clipping. This example illustrates the futility of adjusting the deviation of a rig with a low-amplitude signal not "hitting" the clipping threshold.

On the other hand, the effects of adjusting the gain control are shown in Fig. 6. Note that the overdeviation can't occur at any setting, provided the deviation setting is correct. Only the amount of clipping is

affected by turning the gain control. (The "amount" of clipping is the ratio of the peak amplitude of the unclipped wave to the peak amplitude of the clipped wave, expressed in dB.)

Most commercial rigs don't have gain controls at all, and many lack sufficient gain to operate the clipper. In the latter case the only way to get good "talk power" is to speak louder, change to a microphone with higher output or add an amplifier stage.

Phase Modulation

It is usually simpler to generate phase modulation than true FM, because phase modulation can be applied to a subsequent stage and be independent of the oscillator. However, in a phase modulator the same modulating voltage at different audio frequencies produces different amounts of deviation, whereas in a true FM system all frequencies are deviated equally. In order to equalize the response of a PM transmitter so as to provide an FM signal, an extra processing step is needed. Between the clipper and the modulator it is necessary to insert an R-C network having less output at high audio frequencies than at low ones. The amount of rolloff necessary is 6 dB per octave. Figure 4(b) illustrates the sequence of processing steps required in a phase-modulated transmitter.

The Real World

A practical effect of voice waveforms (in contrast to the sine waves used in the illustrations) is that different voices make a difference in the resulting overall effectiveness of the system. Some voices don't even need clipping to sound good, while others need large amounts of it. You may find that the effectiveness of your signal can be improved as a result of experimentation with the speech amplifier frequency response and the amount of clipping.

You'll probably find disagreement of reports in on-the-air tests. Some of the disparity is attributable to subjective preferences, but most commonly it is due to differences in receivers. In FM the modulation limit is set by the receiver bandpass characteristics instead of natural boundaries

at the transmitter in AM. Thus one receiver may accept only 5 kHz of deviation while another accepts 10 kHz before overdeviation is apparent. In order to resolve this problem an artificial standard of deviation must be set. Most amateur FM groups have shifted from the wide-(15 kHz) to the narrow-(5 kHz) band standard as of this writing.

Notice that the term "receiver bandwidth characteristics" has replaced the common reference to "receiver bandwidth." Depending upon the design of the receiver, there are varying degrees of difference between actual and theoretical responses to overdeviation. Figure 7 shows two receiver passband response curves. Both are 15 kHz wide at the 3 dB point, hence they have the same bandwidth, right? Not necessarily. Due to the fact that FM receivers use limiters and to the resulting capture effect, stronger signals work farther down the sides of the filter response curve than weak ones. The limiters level off the filter response curve above the point at which the signal line crosses the filter curve. For the receiver in (a) the bandwidth is 15 kHz at the 3 dB point, but it increases to 25 kHz for a signal 10 dB stronger. The receiver at (b), with a better i-f filter, holds the deviation limit more nearly constant with varying signal strength. It can be seen that the (a) receiver is less reliable for adjusting deviation because the deviation limits vary greatly with signal strength.

This effect explains why "compromise" deviation is popular. Narrow-band receivers will accept wider deviation if the signal is strong enough. Where you lose is in ultimate range, where you would like to get the most from your equipment. For maximum range and effectiveness with a given amount of power the transmitter deviation must be matched to the receiver bandwidth at a level near the receiver sensitivity threshold. The receiver at (a) would show better quieting than the one at (b) because its response is greatest at the center of the passband. The test carrier, having no "width," produces a greater response at the center of the passband in (a) than in (b). However, the (a) receiver would show distortion on weak signals because the bandwidth approaches zero as the signal drops in level, while the (b) receiver would recover the modulation

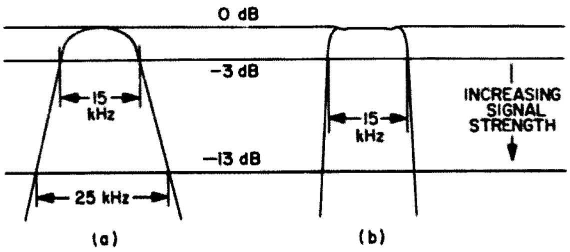


Fig. 7. Comparison of bandwidth at different points of the passband of two receivers. Stronger signals find the receiver effectively wider than weak ones.

clearly. The test of a good receiver is how the signal sounds as it fades out. A good receiver doesn't show distortion on a properly modulated signal as it fades out. Audio output and quality remains constant, and the impression it gives is that the noise level rises to "bury" the signal, rather than the signal dropping into the noise. A ripply pass-band (non-flat passband response) also degrades receiver weak-signal response.

In any case, any receiver deviation test requires that the transmitter carrier frequency be accurately centered on the receiver passband. An off-frequency condition sounds like overdeviation even when the deviation level is correct.

Clipping – Hard or Soft?

Ideally, a clipper leaves all parts of a wave that are below the clipping threshold undistorted, and limits to a constant value all parts exceeding the threshold. Once the threshold is reached, any further increase in input level has no effect on the output

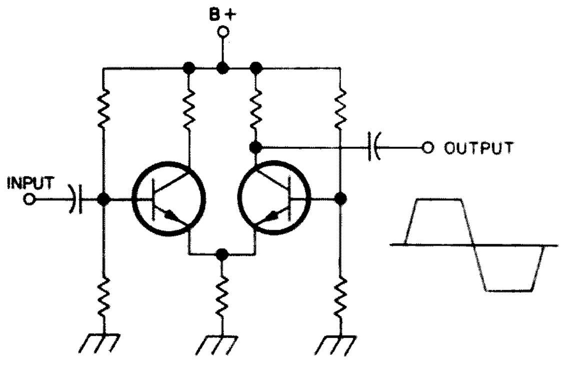


Fig. 8. A differential amplifier is a good example of a "hard" clipper circuit.

amplitude. Such a clipper circuit is termed "hard" and is the best for holding the line on deviation. A differential amplifier circuit such as that shown in Fig. 8 approaches the ideal hard clipper characteristics when operated into saturation.

Other clipping circuits such as the diode circuit of Fig. 9 have varying degrees of "softness." In a sense a soft clipper is a compromise between no clipper at all and a hard clipper, and an infinite variation of "softness" is possible. Because the output continues to rise slightly with increasing input amplitude, the deviation level for a soft clipper must be set somewhat lower at the clipping threshold than the desired maximum deviation level. The advantage of a soft clipper is that the output contains less distortion and requires less filtering.

In either case it is imperative that clipping action take place symmetrically on the positive and negative peaks. If either the shape or the amplitude of the clipped wave differs in the two polarities, a whole new set of distortion products is generated, consisting of even-order harmonics. A symmetrical wave contains only odd harmonics while an asymmetric clipped waveform contains both evens and odds. Another disadvantage of poor symmetry is that talk power is compromised, since the higher-amplitude peak determines the deviation setting. If the other peak is significantly lower it won't reach full deviation.

Better Ways

A compression amplifier, when used in combination with a clipper-filter, forms an improved speech processing system. The compression amplifier acts to maintain a constant average voice level at the input of the clipper, thereby regulating the amount of clipping to a predetermined value. Thus, talk power is maintained at a constant level, even if you drift from the microphone. A compression amplifier by itself can help correct for poor microphone technique, but it can't raise talk power much because it doesn't alter the voice waveform. It doesn't operate instantaneously as does a clipper, hence it can permit bursts of overdeviation. However, when it is used in combination

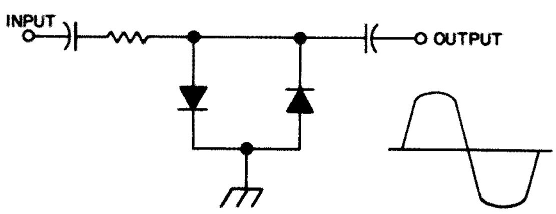


Fig. 9. A diode clipped produces an output having some degree of "softness," depending upon diode characteristics.

with a clipper a compression amplifier is very effective.

Points to Remember

Before adjusting deviation:

(1) Use a receiver with the correct bandwidth.

(2) Make sure the receiver and the transmitter to be adjusted are exactly on the same frequency.

(3) Set the level with sufficient audio input to reach the clipping threshold. If in doubt, look for the clipped waveform on a scope.

(4) Use a weak signal at the receiver – preferably with a trace of noise to prevent widening of the effective receiver bandwidth.

(5) Once the deviation setting is properly made, don't touch it again. If "low audio" reports persist, raise the audio gain, not the deviation.

(6) Audio quality must be maintained at both ends of a radio link. Before you use your receiver to critique other signals, make sure it is matched in frequency and bandwidth with the appropriate standards.

Even with infinite clipping the human voice remains highly intelligible (J. Licklider and I. Pollack, "Effects of Differentiation, Integration, and Infinite Peak Clipping upon the Intelligibility of Speech," *Journal of the Acoustical Society of America,* vol. 18, pp 42–51; January 1947). However, only a modest amount of clipping is needed to produce a large improvement in intelligibility under marginal signal conditions. Hmm . . . I wonder if there isn't some way to improve the intelligibility of a technical article by . . . !

. . .W2EUP

FCC RULES AND REGULATIONS, PART 97 (III)

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

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CALL SIGNS

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DUPLICATE LICENSES AND LICENSE TERM

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§ 97.40 Station license required.

(a) No transmitting station shall be operated in the amateur radio service without being licensed by the Federal Communications Commission.

(b) Every amateur radio operator must have a primary amateur radio station license.

(c) An amateur radio operator may be issued one or more additional station licenses, each for a different land location, except that repeater station, control station, and auxiliary link station licenses may also be issued to an amateur radio operator for land locations where another station license has been issued to the applicant.

(d) Any transmitter to be operated as part of a control link shall be licensed as a control station or as an auxiliary link station and may be combined with a primary, secondary, or club station license at the same location.

(e) A transmitter may only be operated as a repeater station under the authority of a repeater station license.

[§ *97.40 added eff. 10-17-72; VI(72)-1*]

§ 97.41 Application for station license.

(a) Each application for a club or military recreation station license in the amateur radio service shall be made on the FCC Form 610-B. Each application for any other amateur radio station license shall be made on the FCC Form 610.

(b) Each application shall state whether the proposed station is a primary or additional station. If the latter, the application shall also state whether the proposed station is a secondary, control, auxiliary link, or repeater station.

(c) When an application(s) is made for a station having one or more associated stations, i.e., control station and/or auxiliary link station, a system network diagram shall also be submitted.

(d) Each application to license a remotely controlled amateur radio station, whether by wire or by radio control, shall be accompanied by a statement giving the address for each control point. The application shall include a functional block diagram and a technical explanation sufficient to describe the operation of the control link. Additionally, the following shall be provided:

(1) Description of the measures proposed for protection against access to the remote station by unauthorized persons.

(2) Description of the measures proposed for protection against unauthorized station operation, either through activation of the control link or otherwise.

(3) Description of the provisions for shutting down the station in case of control link malfunction.

(4) Description of the means to be provided for monitoring the transmitting frequencies.

(5) Photocopies of control station license(s) and auxiliary link station license(s), or the application(s) for same if such stations are proposed for the system network.

(e) Each application to license a control station or an auxiliary link station in the amateur radio service must be accompanied by the following information:

(1) The station transmitting band(s).

(2) Description of the means to be provided for monitoring the transmitting frequencies.

(3) The transmitter power input and justification that such power is in compliance with § 97.67(b).

(4) If remote control of an auxiliary link station is proposed, all of the information required by paragraph (d) of this section shall also be provided.

(f) Each application to license a repeater station in the amateur radio service must include the following information for each frequency band proposed for operation.

(1) Location of the station transmitting antenna, drawn upon a topographic map having the scale of 1:250,000 and a contour interval of 50 feet.[1]

(2) The transmitting antenna height above average terrain.[2]

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[1] **See pages 50 and 51 in the July issue of 73 for ordering information.**
[2] **See Appendix 5, reprinted in part below:**

DETERMINATION OF ANTENNA HEIGHT ABOVE AVERAGE TERRAIN

The effective height of the transmitting antenna shall be the height of the antenna's center of radiation above "average terrain." For this purpose "effective height" shall be established as follows:

(a) On a U.S. Geological Survey Map having a scale of 1:250,000, lay out eight evenly spaced radials, extending from the transmitter site to a distance of 10 miles and beginning at (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° T.) If preferred, maps of greater scale may be used.

(b) By reference to the map contour lines, established the ground elevation above mean sea level (AMSL) at 2, 4, 6, 8, and 10 miles from the antenna structure along each radial. If no elevation figure or contour line exists for any particular point, the nearest contour line elevation shall be employed.

(c) Calculate the arithmetic average of these 40 points of elevation (5 points of each of 8 radials).

(d) The height above average terrain of the antenna is thus the height AMSL of the antenna's center of radiation, minus the height of average terrain as calculated above.

[*Appendix 5 added new eff. 10–17–72; VI (72)–1*]

(3) The effective radiated power in the horizontal plane for the main lobe of the antenna pattern, calculated for maximum transmitter output power.

(4) The transmitter power output with an explanation of the basis for the measurement or computation.

(5) The loss in the transmission line between the transmitter and the antenna expressed in decibels, and method of determination of the loss.

(6) The horizontal and vertical radiation patterns of the transmitting antenna as installed, with reference to true north (for horizontal pattern only), expressed as relative field strength (voltage) or in decibels, drawn upon polar coordinate graph paper, and method of determination of the patterns.

(7) The relative gain of the transmitting antenna in the horizontal plane and method of determination of the gain.

(8) If remote control of the repeater station is proposed, all of the information required by paragraph (d) of this section also shall be provided.

(9) If auxiliary link station(s) are also proposed, include photocopies of the auxiliary link station license(s), or the application(s) for such licenses.

(g) One application and all papers incorporated therein and made a part thereof shall be submitted for each amateur station license. If the application is for station license only, it shall be filed directly with the Commission at its Gettysburg, Pa., office. If the application also contains application for any class of amateur operator license, it shall be filed in accordance with the provisions of § 97.11.

(h) Applicants proposing to construct a radio station on a site located on land under the jurisdiction of the U.S. Forest Service, U.S. Department of Agriculture, or the Bureau of Land Management, U.S. Depart-

ment of the Interior, must supply the information and must follow the procedure prescribed by § 1.70 of this chapter.

[§ *97.41 revised eff. 10-17-72; VI(72)-1*]

§ 97.43 Location of station.

Every amateur station must have one land location, the address of which is designated on the station license. Every amateur radio station must have at least one control point. If the control point location is not the same as the station location, authority to operate the station by remote control is required.

[§ *97.43 revised eff. 10-17-72; VI(72)-1*]

§ 97.45 Limitations on antenna structures.

(a) Except as provided in paragraph (b) of this section, an antenna for a station in the Amateur Radio Service which exceeds the following height limitations may not be erected or used unless notice has been filed with both the FAA on FAA Form 7460-1 and with the Commission on Form 714 or on the license application form, and prior approval by the Commission has been obtained for:

(1) Any construction or alteration of more than 200 feet in height above ground level at its site (§ 17.7 (a) of this chapter).

(2) Any construction or alteration of greater height than an imaginary surface extending outward and upward at one of the following slopes (§ 17.7(b) of this chapter):

(i) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport with at least one runway more than 3,200 feet in length, excluding heliports and seaplane bases without specified boundaries, if that airport is either listed in the Airport Directory of the current Airman's Information Manual or is operated by a Federal military agency.

(ii) 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport with its longest runway no more than 3,200 feet in length, excluding heliports and seaplane bases without specified boundaries, if that airport is either listed in the Airport Directory or is operated by a Federal military agency.

(iii) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport listed in the Airport Directory or operated by a Federal military agency.

(3) Any construction or alteration on an airport listed in the Airport Directory of the Airman's Information Manual (§ 17.7(c) of this chapter).

(b) A notification to the Federal Aviation Administration is not required for any of the following construction or alteration:

(1) Any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation. Applicants claiming such exemption shall submit a statement with their application to the Commission explaining the basis in detail for their finding (§ 17.14 (a) of this chapter).

(2) Any antenna structure of 20 feet or less in height except one that would increase the height of another antenna structure (§ 17.14(b) of this chapter).

(c) Further details as to whether an aeronautical study and/or obstruction marking and lighting may be required, and specifications for obstruction marking and lighting when required, may be obtained from Part 17 of this chapter, "Construction, Marking, and Lighting of Antenna Structures." Information regarding the inspection and maintenance of antenna structures requiring obstruction marking and lighting is also contained in Part 17 of this chapter.

§ 97.47 Renewal and/or modification of amateur station license.

(a) Application for renewal and/or modification of an individual station license shall be submitted on FCC Form 610, and application for renewal and/or modification of an amateur club or military recreation station shall be submitted on FCC Form 610-B. In every case the application shall be accompanied by the applicant's license or photocopy thereof. Applications for renewal of unexpired licenses must be made during the license term and should be filed not later than 60 days prior to the end of the license term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(b) If a license is allowed to expire, application for renewal may be made during a period of grace of 1 year after the expiration date. During this 1-year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of expiration. An application for an individual station license shall be submitted on FCC Form 610. An application for an amateur club or military recreation station license shall be submitted on FCC Form 610-B. In every case the application shall be accompanied by the applicant's expired license or a photocopy thereof.

(c) When the name of a licensee is changed (without changes in the ownership, control, or corporate structure), or when the mailing address is changed (without changing the authorized location of the amateur radio station) a formal application for modification of license is not required. However, the licensee shall notify the Commission promptly of these changes. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in the Commission's records, the new name and/or address, as the case may be, and the call sign and the class of operator license. The notice shall be sent to Federal Communications Commission, Gettysburg, Pa., 17325, and a copy shall be maintained with the license of each station until a new license is issued.

(d) When an addition to the control point(s) authorized for a remotely controlled station is desired, an application for modification of the remotely controlled station license shall be submitted. Authorized control points may be deleted by letter notification to the Commission.

(e) Should the licensee desire to effect changes to his station which would significantly change the system network diagram or other technical and operational information on file with the Commission, revised showings for the proposed alterations shall be submitted for approval. An application for modification of the station license is not required.

[§ *97.47 Note deleted and pars. (d) & (e) added eff. 10-17-72; VI(72)-1*]

§ 97.49 Commission modification of station license.

(a) Whenever the Commission shall determine that public interest, convenience, and necessity would be

served, or any treaty ratified by the United States will be more fully complied with, by the modification of any radio station license either for a limited time, or for the duration of the term thereof, it shall issue an order for such licensee to show cause why such license should not be modified.

(b) Such order to show cause shall contain a statement of the grounds and reasons for such proposed modification, and shall specify wherein the said license is required to be modified. It shall require the licensee against whom it is directed to appear at a place and time therein named, in no event to be less than 30 days from the date of receipt of the order, to show cause why the proposed modification should not be made and the order of modification issued.

(c) If the licensee against whom the order to show cause is directed does not appear at the time and place provided in said order, a final order of modification shall issue forthwith.

Call Signs

§ 97.51 Assignment of call signs.

(a) The call signs of amateur stations will be assigned systematically by the Commission with the following exceptions:

(1) A specific unassigned call sign may be reassigned to the most recent holder thereof;

(2) A specific unassigned call sign may be assigned to a previous holder if not under license during the past 5 years;

(3) A specific unassigned call sign may be assigned to an amateur organization in memoriam to a deceased member and former holder thereof;

(4) A specific call sign may be temporarily assigned to a station connected with an event, or events, of general public interest;

(5) One unassigned two-letter call sign (a call sign having two letters following the numeral) may be assigned to a previous holder of a two-letter call sign, the prefix of which consisted of not more than a single letter. Additionally, a two-letter call sign may be assigned to an Amateur Extra Class licensee who submits evidence that he held any amateur radio operator or station license, issued by any agency of the U.S. Government or by any foreign government, 25 years or more prior to the receipt date of an application for such assignment. Applicants for two-letter call signs are not permitted to select a specific assignment except in accordance with subparagraphs (1) and (2) of this paragraph.

(b) An amateur call sign will consist of a sequence of one or two letters, a numeral designating the call sign area, and two or three letters. The call sign areas are as follows:

No.

1. Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.
2. New York, New Jersey.
3. Pennsylvania, Delaware, Maryland, District of Columbia.
4. Virginia, North and South Carolina, Georgia, Florida, Alabama, Tennessee, Kentucky, Puerto Rico and Virgin Islands.
5. Mississippi, Louisiana, Arkansas, Oklahoma, Texas, New Mexico.
6. California, Hawaii and Pacific possessions except those included in area 7.
7. Oregon, Washington, Idaho, Montana, Wyoming, Arizona, Nevada, Utah, Alaska and adjacent islands.
8. Michigan, Ohio, West Virginia.
9. Wisconsin, Illinois, Indiana.
10. Colorado, Nebraska, North and South Dakota, Kansas, Minnesota, Iowa, Missouri.

§ 97.53 Policies and procedures applicable to assignment of call signs.

(a) The following are regarded as preferred call signs:

(1) Two-letter call signs—call signs with a single letter prefix (two-letter prefix in Alaska, Hawaii, and in the U.S. possessions) and a two-letter suffix; e.g. W6AB (KH6AB).

(2) Three-letter call signs—call signs with a single letter prefix and a three-letter suffix; e.g. W6ABC.

(b) An eligible licensee will be permitted to hold only one two-letter call sign. However, a licensee who, by reason of former rule provisions, presently holds more than one such call sign may continue to hold these call signs in the same call sign areas.

(c) Subject to availability, two-letter call signs beginning with the letter "W" will normally be assigned in each call sign area to eligible licensees.

(d) An eligible licensee who holds one or more three-letter call signs must relinquish one of those call signs in order to be assigned a two-letter call sign.

(e) New additional stations will not be assigned a preferred call sign.

(f) An additional station which is presently assigned a preferred call sign will be issued a nonpreferred call sign upon modification of license to show a station location in a different call sign area.

(g) Subject to availability, a basic station will be issued the same type of call sign as the one relinquished upon modification of license to show a station location in a different call sign area.

(1) Licensees will not be assigned specific call signs or their choice of counterpart call signs (call signs with identical suffix letters) under this provision.

(2) When a two-letter call sign is not available in the new call sign area, an eligible licensee may be assigned an available unspecified three-letter call sign.

(h) Call signs which have been unassigned for more than one year are normally available for reassignment.

Duplicate Licenses and License Term

§ 97.57 Duplicate license.

Any licensee requesting a duplicate license to replace an original which has been lost, mutilated, or destroyed, shall submit a statement setting forth the facts regarding the manner in which the original license was lost, mutilated, or destroyed. If, subsequent to receipt by the licensee of the duplicate license, the original license is found, either the duplicate or the original license shall be returned immediately to the Commission.

§ 97.59 License term.

(a) Amateur operator licenses are normally valid for a period of 5 years from the date of issuance of a new or renewed license, except the Novice Class which is normally valid for a period of 2 years from the date of issuance.

(b) The license for an amateur station is normally valid for a period of 5 years from the date of issuance of a new or renewed license, except that an amateur station license issued to the holder of a Novice Class amateur operator license is normally valid for a period of 2 years from the date of issuance. All amateur station licenses, regardless of when issued, will expire on the same date as the licensee's amateur operator license.

(c) A duplicate license or a modified license which is not being renewed shall bear the same expiration date as the license for which it is a modification or duplicate.

(To be continued next month)

(con't. from page 38)

"EIA has estimated that the proposed Class E Service could produce 10 million licenses. . ."

tenna limitations, channel capability, frequency control, etc. Additional comments on recommended receiver characteristics are also invited, as well as estimated equipment costs to the user.

f. The feasibility, cost, operational use and potential effectiveness of automatic transmission of call sign or station identification as an aid to self or Commission enforcement, or for other purposes.

g. Appropriate measures to be followed regarding initial and updated registration of Class E operations for purposes of achieving efficient channel utilization, enforcement follow-up, etc.

h. The feasibility and desirability, including estimated social and economic impact, of phasing out either personal or business use of Class D service @ 27 MHz in favor of the surviving use, in conjunction with the establishment of a new Class E service.

i. The feasibility, desirability, and legality of Commission confiscation, uhder certain conditions, of equipment operated illegally.

11. Any schedule for implementing the new radio service operations at 224–225 MHz will have to consider the availability to the Commission of budget allocations in order to provide for the additional administration and enforcement of rules. EIA has estimated that the proposed Class E Service could produce 10 million licensees. The Commission solicits comments on this and other estimates of total license impact as well as the methodology and/or calculations that support such estimates. Comments are also requested regarding possible procedures for licensing and enforcement which would minimize the administrative burdens resulting from such a large number of users.

12. In the event that a portion of the 220–225 MHz amateur band is reallocated to other services, detailed amendments to the rules governing all services involved will be developed and proposed after review of the comments received in response to this proposal. The proposed amendment of Section 2.106 (Table of Frequency Allocations) is set forth in the attached Appendix .

13. Action herein is being taken pursuant to authority contained in Sections 4(i), 303 and 403 of the Communications Act of 1934, as amended.

14. Pursuant to applicable procedures set out in Section 1.415 of the Commission's Rules, interested parties may file comments on or before September 20, 1973, and reply comments on or before October 22, 1973. All relevant and timely comments and reply comments will be considered before final action is taken in this proceeding. The Commission, additionally, in reaching a decision in this proceeding, may also take into account other relevant information before it.

15. In accordance with the provisions of Section 1.419 of the Commission's Rules, an original and 14 copies of all comments, replies, pleadings, briefs, or other documents shall be furnished the Commission. Responses will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D.C.

Federal Communications Commission
Ben F. Waple
Secretary

APPENDIX

Part 2 of Chapter 1 of Title 47 of the Code of Federal Regulations is amended as follows:

1. §2.106 [amended]

UNITED STATES		FEDERAL COMMUNICATIONS COMMISSION				
Band (MHz)	Allocation	Band (MHz)	Service	Class of Station	Frequency (MHz)	Nature
5	6	7	8	9	10	11
***	***	***	***	***	***	***
220–224	G, NG. (US34)	220–224	Amateur. (NG13)	Amateur.		AMATEUR.
224–225	G, NG. (US121)	224–225	Fixed. Mobile. (NG68) (NG69)	Base Fixed. Mobile.		FIXED. MOBILE.

2. NG13 is amended to change the pertinent band limits from 220–225 MHz to 220–224 MHz.

3. New footnotes NG68 and NG69 are added in appropriate numerical sequence to read as follows:

NG 68 In those portions of the States of Texas and New Mexico in the area bounded on the south by parallel 31° 53′ N, on the east by longitude 105° 40′ W, on the north by parallel 33° 24′ N and on the west by longitude 106° 40′ W and in the State of Florida the counties of Gulf and Franklin and the contiguous water areas of the Gulf of Mexico extending to 30 miles off shore, the frequency band 224–225 MHz is not available for use by fixed, base and mobile stations between the hours of 0500 and 1800 local time Monday through Friday, inclusive, of each week.

NG 69 Pending the outcome of coordination with Canada and Mexico, fixed and mobile stations are not authorized to operate within ten miles of the international boundary with these countries; base stations are not authorized to operate within twenty miles of the international boundary with these countries.

4. US34 is amended to change the pertinent band limits from 220–225 MHz to 220–224 MHz.

5. A new footnote US121 is added in appropriate numerical sequence to read as follows:

US121 The only non-Government service permitted in the band 224–225 MHz is by stations of the fixed and mobile services. These stations shall be on a secondary basis to and not cause harmful interference to the Government radiolocation service.

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

GONSET Communicator III 2 meters $100, Gonset 3063 2 meter power amplifier $75, package $150; Motorola P-338AC with Ni-Cads 94/94 34/94 $125; Heath HX-20 $110, HR-20 $75, HP-20 $25, HP-10 $35, Hustler 80-10 mobile antennas mast mount $35, package $245; you pay shipping – W5PNY, 2506-A 35th St., Los Alamos, New Mexico 87544.

"AMATEUR RADIO" automobile license plate frames. $3.50 each, $6.00 pair. Will fit most all cars. Center Place Communications, Dept. C, Box 26, Independence, MO 64051.

COMPLETE STATION $525 firm or separate as listed, HT 37 $185, SX101A $155, HA 2 with PS $125, Home Brew Linear (matches HT 37 1000Watts) $100, D104 $15, Johnson Matchbox two 10 element 2 mtr collinears with stacking kit $25; will not sell separate before chance to sell complete. Also have back issues of QST from 1925 up – most complete – send SASE for list – would prefer to sell complete – Write K1VNE, Tom, 22 Lockwood St., Bellows Falls, Vt. or call days 802-254-9988, 802-463-4209.

SSTV Monitor tubes 5 to 12 inch P7 $12.50 to $28.00. Limited quantity 53 and 70 degree yokes $5.00. Sold only with tubes. SASE specs, prices, Lotz W5HCO 750 Florida Boulevard, New Orleans LA 70124.

FOUNDATION for AMATEUR RADIO annual Hamfest Sunday 21 October 1973 at Gaithersburg Maryland Fairgrounds.

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send S.A.S.E. showing make and model number. K3KUL, Joseph C. Crockett, 762 S. Gulph Road, King of Prussia, Pa., 19406.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾/m	$255
Digital Logiclocks	$80
Midland 13509 220 xcvr	$200
Midland 1520 hand-held 2 meter	$190
SBE 450 450 xcvr	$340
Clegg 27B 2m xcvr	$380
Dycomm 2m repeater	$425
Standard repeater	$550
HR-6 25W	$190
Wilson 6 el. 20m beam (pick-up only)	$250
Wilson 7 el. 15m beam (pick-up only)	$250

SERVO CORP sweeper 2-4 gig sweep up or down 2 settable markers $225.00. NM50A with ps, cables & accessories, $325.00. Beckman R-1 Fitgo amplifier 1000 meg input imped, $125.00. 70/752 VDT nice, $900.00. Alfa-Numeric keyboard from Univac VDT. $40.00. SASE for list. Douglas Craton, 5625 Balfrey Dr., W. Palm Beach, Fla. 33406.

FINDLAY ANNUAL HAMFEST, Riverside Park, Findlay, Ohio – Sunday, Sept. 9 – Advance Donation Tickets $1.00 from C. Foltz W8UN, W. Hobart, Findlay, Ohio 45840.

NATIONAL SECURITY AGENCY miniature printer, in original boxes; Teletype #109000 (Model 51). $8.95 each, or 3 for $25. Include postage for 20 pounds. Jim Cooper, 651 Forest Avenue, Paramus, NJ 07652.

AUGAT 9009 sincs for TO 36 2–$1.50 with 2N173 or 2N441 $2.00. Anyone have some cheap ART 13 or ARC 5, prefer close. 2N173 – 2N441 pulls 4/$1.00. 2N2016 pulls 3/$1.00 with cross reference. SASE for list of test equipment. Trade any items for Valiant, Viking. Linears, good receivers. Will buy if reasonable. 14 typing reperf. with keyboard $10.00. Douglas Craton, 5625 Balfrey Dr., W. Palm Beach, Fla. 33406.

NOVICES: DX-40, HQ 110, Johnson 122 VFO. Johnson T-R switch, SWR meter (both new). Good condition. All shipped for $185. WN4WFA, Box 547, Hudson, N.C. 28638.

GIANT N. E. CONVENTION sponsored by FEMARA Sept. 29 & 30 at Dunfey's Hyannis Resort on Cape Cod. Huge flea market, seminars, FM, SSTV, NEDXCC, AMSAT, YL trips, 2 pools, golf, beaches, sailing. Early bird registration still only $3 from W1ZQQ, 17 Barnes Aveneue, E. Boston, Mass. 02128.

TELETYPE MACHINES by Kleinschmidt. Page Printer with Power Supply, as received from Govt., $59.95. Single tables, excellent condition, $19.95. Page Printer and Reperf combination, as received from Govt., $59.95 ea. Double tables, excellent with Chad Box and Tape compartments for $34.95. Each of the above TT Machines cleaned, oiled and adjusted please add $30.00 ea. TH-5 Converters, transmit and receive on 170 shift, $49.95. Paper winders $14.95. TDMS Teletype Transmitter $19.95. Power Supply $24.95. Freight is collect on all orders. Andy Electronics, Inc./6431 Springer/Houston, Texas. 77017.

CANADIANS – FREE 120 page electronics catalog ETCO-B, 464 McGill, Montreal.

2MTR GE MASTR PRO – 80 watt output, four frequency, fully bandchanged in accordance with factory specs for the Low Split. Channel Guard on both transmit and receive. Includes crystals for 52/52, 16/76, 28/88 and 34/94, microphone, control head, speaker, control and power cables, fuse block, mobile mounting rack and GE Maintenance Manual. $650. F.O.B. Rapid City. Andy Demartini, WB2VUJ/Ø, PSC Box 1973, Ellsworth AFB, South Dakota 57706.

MIX PLEASURE WITH PLEASURE. 1973 Hamburg International Hamfest on Sept. 15 only 45 minutes from fabulous Niagara Falls. RV parking for weekend only $2.50 with hook-up. Details: Valerie Orgera K2KQC, 187 Main, Hamburg, N.Y. 14075.

SPECIALIZED REPAIR SERVICE We offer a complete repair service on all Collins receivers & transceivers listed. R-388-389-390-390A-392-392. All S-line receivers & transceivers including 51S-1-651S-1 receivers. We stock and sell all parts for the above receivers. We also service all Collins Avionics equipment. Such as Arc-73, Arc-94, Arc-102, Arc-114, Arc-115-116-131-134, Arc-38A, Arc-58, 618-T. We also buy the above Avionics sets any quantity any cond. We will send price list upon request. D & R Electronics, R.D. No.1, Box 56, Milton, Pa. 17847. 1-717-742-4604.

WANT OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

HAMFESTERS 39th Hamfest and Picnic, Sunday, August 12, 1973, SANTA FE PARK, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OM's and XYL's, Famous Swappers Row. Information contact John Raiger K9DRS, 8919 Golfview, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 So. California Ave., Chicago, Ill. 60629.

GLADDING 25 – with latest factory modifications – $175. Crystals for Gladding – Transmit 146.01, .13, .16, .22, .25, .28, .31, .46, .52. Receive 146.52, .64, .73, .82, .85, .88, .91, and 147.50. $3.50 each postpaid. Dick Eastman, K1OJH, Box 114, St. Johnsbury, Vermont, 05819.

WARREN HAMFEST Largest family style Hamfest in East. Sunday, August 19th, @ Famous Yankee Lake Park. Giant Fleamarket, Swimming, Picnicking – All Free. Details QSL W8VTD.

FOR SALE: Heathkit SB-300, mint condition, all new tubes, has scarcely been used, $200. Eico 720 transmitter, mint condition, with 722 VFO, the perfect novice transmitter, $100. Model 19 Teletype machine, mint condition, with unshift on space, 75 WPM and 60 WPM gears, $135. Marsan Television Camera, fast-scan, video or RF output, adaptable to SSTV, $180.00. All items are plus shipping. C. Fine, WB2CNH, 570 North Street Harrison, New York 10528. Tel: 914-967-2652.

REGULATED D-C POWER SUPPLY, output 300±25-v., 160-ma., 1-mv ripple. Several unregulated A-C outputs, 115-v/60Hz input. New cond. $100. Lovins, Weston Road, Lincoln, Mass. 01773. 617-259-8938.

TECH MANUALS – $6.50 each: R-389/URR, R-390/URR, R-220/URR, R-274/FRR, TS-382D/U, CV-591A/URR, TS-34A/AP, TS-497B/URR, SP-600JX, RCK, TT-6A/FGC, LM-21, ALR-5, OS-8C/U. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Regency, Genave, Drake, Standard, Clegg, Hallicrafters, Ten-Tec, Kenwood, Tempo, Midland, Galaxy, Mosley, Hy-Gain, CushCraft, Ham-M, Hustler, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal, friendly Hoosier service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812)-894-2397.

NOVICE-TECHNICIAN code for beginners. Voice and code instructions. Cassettes only Send money order to Brobak Sales, Box 172, Mattapan, Mass. 02126. Each $3.25.

ROANOKE DIVISION CONVENTION – Sept. 14–16, 1973, Reston, Va. (near Dulles Airport) Unusual wide interest programs and sessions. Write K4MD, Box 7388, Warrenton, Va. 22186.

WESTERN UNION DESK-FAX transceiver manual: Complete theory of operation, adjustment, lubrication, preventive maintenance, troubleshooting, parts list. Includes all schematics and mechanical parts drawings. $3.80 postpaid. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

"DON and BOB" guaranteed buys. Discount prices plus full warranty. Triex MW50 tower 250.75; MW65 331.50; W51 386.00 FOBCAL. Ham-M 99.00; TR44 59.95; AR22R 31.95; Belden 8 wire rotor cable #8448 10¢/FT; Mosley CL36 149.00; CL33 124.00; TA33 114.00; MCQ3B 91.00; S402 143.00; MP33 90.00; Belden 8214 RG8FOAM 17¢/ft; Motorola HEP170 Epoxy Diode 2.5A/1000PIV 29¢ 25.00/100; KY65 code ider 5.95; Write specific needs new panel meters, stock; quote discontinued tubes; quote Clegg FM27B; Genave GTX2; Regency HR212; Midland 13500; Standard; Collins and CDE replacement parts; Hallicrafters FPM300 (595.00L) 499.00; Hardbound technical magazines, many types from petrochemical library 3.00/yr write needs. 9PIN ceramic 6LQ6 socket 50¢; 6V/12V/24V/1.5A transformer 2.49; Collins 75A4 345.00; Kenwood T599 350.00. Shipping charges collect. Madison Electronics, 1508 McKinney, Houston, Texas 77002 713/2242668.

SBE 36 9 month old mint transceiver 500 PEP digital readout 80-10 $595. K1RES, Peter Williamson, 132 Winthrop St., Augusta, Maine 04330. 622-1949 after 5:00.

GLOBAL RESEARCH & Supplies. SBE SB-50 $349.95, SB3-AC $42.50. HY-Gain 6 meter Linear 220 watts, mobile #404 $129.95, Base $109.95. Tempo 6n2 KW linear $595.00. Genave GTX-2 $249.95. GTX-10 $199.95, GTX-200 $259.95, Comcraft CTR-144 $489.00. Write for catalog: P.O. Box 271, Lombard, Ill., 60148.

PLASTIC ENGRAVED CALL PLATES w/pin $1.25. WA2UUY, 15 Vincent St., Parlin NJ 08859.

73 FLAG NEEDED – PLEASE. The 73 banner was inadvertently left behind at the Dayton Hamvention in 1971. Last year someone mentioned that they had it and would return it. We hoped that 1973 would be the big year for getting this banner back, but Dayton came and went without same. Please – whoever has the banner – we *need* it. Any info on the whereabouts of our banner will be appreciated.

(W2NSD/1 continued from p.19)

taken by surprise. Thank heavens there are so few of them left.

What I had intended to say to the Midcars group was that I think their type of operation is of immediate and first order importance to amateur radio and to our country. Frankly, I doubt if many amateurs appreciate just how important emergency communications is now and may be in the future.

Those of you who read more than amateur radio magazines are probably aware that a bargain has been struck between the U.S. and the U.S.S.R. regarding nuclear warfare. To put it bluntly, the population of the U.S. is being held hostage – particularly in the larger cities. Ditto the Russian population. The agreement appears to be that we will not pursue civil defense and anti-ballistics missiles if they won't. We see the results – a virtual total decay of CD, with shelters abandoned as a means of safety, and no alternate.

What does this mean to us as radio amateurs? It means that should something ever go wrong with this bargain that the ONLY communications that the country will have will be amateur radio. This is when experience and equipment for the service nets such as Midcars will become valuable beyond reckoning. This is when we will need every repeater we can get – every cross-band system – every mobile – every battery or portable powered base station.

If the leadership and progress of our service nets is in the hands of amateurs like William G. Blankenship K4DLA, then it looks to me as if we are in deep trouble. We need progressive and enthusiastic people to move us along and we must beware of old-timers with frozen thinking.

Contrast the Midcars leadership (or is that the right word?) with that of Eastcars where we have truly far thinking and enlightened amateurs such as Harold Winston WA2DIR as leaders. Poor old Blankenship should have been retired years ago.

PICTURES NEEDED

We're still looking for good pictures for 73 Magazine – of interesting shacks – of slow scan setups – of RTTY stations – mobile installations – anything unusual.

DAMAGE LIMITATION VS ASSURED DESTRUCTION

Those of our readers who also read the *New Yorker* hopefully read the most interesting series on the history of SALT – the Annals of Diplomacy. It is quite revealing.

The series details the history of how McNamara and Johnson came to an "agreement" with Russia on assured destruction. The proponents of damage limitation wanted to try and keep the destruction of a nuclear exchange to a minimum of defensive missiles (ABM'S) and civil defense measures. The assured destruction foes believed that the populations of the two nations should stand totally exposed to destruction so that fear of retaliation would deter the other from striking first.

This agreement on assured destruction explains why civil defense has almost disappeared. About the only detectable civil defense activity is the amateur development of repeater FM systems in those areas where CD officials are not too apathetic to even permit this growth. It must be traumatic for the few people who have a sincere interest in the subject to be stopped from going ahead with shelters, sophisticated communications systems, and other preparation which could help save people in case of the ultimate disaster.

Since amateurs are not dependent upon government funds for setting up communications systems, perhaps it would be prudent to keep in mind the

official attitude and set up our emergency communications in readiness in spite of them. Here is something we can do that the government can't because of the agreement with Russia.

OVER ID'd

Most, if not all, FMers are chronic identifiers — they give their calls, the calls of the stations they are working, and even the call of the repeater. and they give them repeatedly (if you'll pardon the expression).

The fact is that probably 75% of the identifying is just plain waste of repeater and QSO time. Habit.

The regulations (97.87) require that you identify at the beginning and end of each transmission or an exchange of transmissions and every ten minutes during a transmission or exchange of transmissions. This means that you only have to identify yourself when you start a contact, every ten minutes during a contact, and when you sign off. A contact on a repeater certainly is an exchange of transmissions and would call for ten minute identifications, not at every "over" — which could mean identification of both (or more) parties every two or three minutes. Look at the time you can save!

The repeater is supposedly identifying itself via CW every five minutes. You can identify yourself every two repeater IDs and be on schedule. There is obviously no reason to voice the repeater call — unless you are at such a loss for something to say that you feel you have to fill in dead air with such nonsense.

If you are working one other station you can give his call when you start the contact and again when you end it. You don't need to give it for the ten minute identifications. If you have more than one other chap in the contact you don't even have to acknowledge him. You can sign out when you are leaving by giving just one other call sign and your own, plus an indication that there are others in the net. "K3TUF and the group, this is W2NSD signing out."

When you are operating mobile or portable you should add the call area at the end of your sign . . . "this is W2NSD portable one." It is no longer necessary to give any closer identification than that.

SSTV on 2m FM

A note from one of the repeater frequency coordinator groups the other day suggested the use of 146.58 for RTTY, FAX and SSTV. As a user of slow scan on the lower bands perhaps it is time to explain what this is all about so a misconception like this does not get too much further.

RTTY is a separate mode of communications. When you make an RTTY contact the chances are that you will not be using voice at all, just TT. On the low bands the RTTY channels are in the CW segments so voice is ruled out. Voice is occasionally used on VHF RTTY channels, but it is rare in my experience — which goes back quite a few years. Some RTTY repeaters won't even let anything but TT through.

Now with slow scan — most contacts are mainly voice, with some pictures thrown in now and then. It is possible to have an all slow scan contact — I had one with an EA8 who spoke no English — but this is not very practical. Slow scanners show pictures of their families — their interests — perhaps some humorous drawings, pictures or cartoons. Then they talk a lot about slow scan — or their other interests which the pictures introduced to the contact.

As slow scan becomes more used I would expect to see it coming through the repeaters as part of regular contacts rather than on separate frequencies. A picture only takes eight seconds to transmit — and the usual barrage of three frames of each picture runs you to 24 seconds.

Wayne

(LETTERS cont. from p. 42)
"original cartons" and "unused" – and for only $15.00! What I wouldn't have given for that in 1947 (or was it 1948?).

I was living in the Chicago area at the time, and TV was in its infancy: in fact, there was no such thing as a network cable connection to New York. All programs were local, but don't feel too sorry for us, however, for on the old Motorola 7" screen (complete with bubble magnifier) we saw such local notables as Dave Garroway, Kukla, Fran and Ollie, and Clifton Utley with the news (Garrick Utley's father). But I'm getting ahead of my story.

The Zenith Radio Corporation, a pioneer in radio and TV, developed a system of scrambling a TV picture over the air, and decoding it in the home with a gadget hooked up to a TV set, and also as I recall, to the telephone line. I'm almost positive memory serves me correctly in recalling that Zenith named it Phonovision. Anyhow they received the very first experimental TV license from the FCC in order to conduct a limited experiment in the Chicago area.

Advertisements appeared in the Chicago papers inviting applications from viewers, and if you were accepted a fortunate few hundred families were to be furnished the mysterious black box and hooked up so as to receive the picture "unscrambled," all in the interest of scientific experiment. I do not know how many applications Zenith had, but I do know there was a limit to how many they could accept, and mine wasn't one of them.

Came the start of the test, and Zenith came on the air with first run movies, and other goodies unheard of in those days of 1947. They would sign on the air with a clear signal and tell you what was going to be shown as a feature, and then they would pull the switch or push a button, or whatever they did, but the result would be the most gosh-awful mess you ever saw. For some time they did not scramble the sound, and it about drove me nuts to hear the sound but to be able to make no sense out of the picture. Being a true experimenter, I set to work to see if anything could be done about it.

The best solution consisted of a 10" fan blade mounted on a small rotor whose speed was continuously variable by means of a 110 volt rheostat. If you squinted through the whirling blades, and kept one hand on the speed control, you could do a fair job of unscrambling the picture. In addition you got a breeze, which, if it was a hot night, wasn't too bad. Now as I look at Meshna's ad and pictures of "3 cartons costing Zenith well over $1000.00," I wonder that a simple concoction like a variable speed fan worked at all, but it did – after a fashion.

Finally Zenith went off the air in Chicago as their experimental license expired, and in late '48 or '49 we got hooked up with New York on the coaxial cable, which was I suspect to be the final blow later on to over-the-air pay TV.

Zenith had another experimental period years later in Hartford, Conn., using essentially the same system used in Chicago, and I would assume that Meshna's surplus gear comes from there. Pay TV is by no means a dead issue, but cable TV, via that same coaxial cable, seems to be the means most practical to bring it into your house.

Meanwhile, Mr. Meshna, I'll buy one of these outfits for $15.00 for old times sake, if you will provide a scrambled TV signal for me to unscramble.

R.M. Baldwin K4ZQR
Louisville, Kentucky

SIGNAL/ONE

As one of those who bought a CX7A partly as a response to ads in 73, I hope you'll employ your well known no-holds-barred approach to telling us just what has happened to the Signal/One Company. Also, who might be willing to take care of our apparently orphaned and manual-less rigs.

Ronald E. Wyllys WB5HZN
Austin, Texas

It is our understanding that Don Payne (Payne Radio) has most of the repair parts for the Signal/One units and there should be little problem in getting service. For that matter, it seems likely that there will be a lot less difficulty now than there was when Signal/One was handling the repairs – some of which stretched out for months and months. Hearsay has it that they did not pay the IRS the employee witholding and this resulted in IRS locking up the plant. We understand the ex-president is now in Europe and no "officials" can be reached. It is interesting that despite the problems, the market for the CX-7A has, if anything, increased. This was undoubtedly the finest ham rig ever made and there is no prospect of anything this state of the art in the works in the forseeable future.

CB PROJECT

I built your rig on page 12 of the June issue of 73, and it works fine. The only problem is when I use the slider in the 1 KW position a lot of garage doors seem to open and I had to use tape on the G&H slots because there aren't any tabs, but overall it is a nice rig.

My main concern is that I didn't receive any warranty card!

Rodger Booth
E. Green, Rhode Island

73 SCREWS UP A CB PROJECT

I have received several inquiries about the Citizen Band Alignment Aid (April 73). The coil diameter was omitted. I.D. for L1 is 8 mm. In other words, wind it on a pencil as a form.

Also, a SASE is sufficient postage for the P.C. board.

Ed Lawrence WA5SWD
Plano, Texas

LIKES STUDY GUIDE

I used your Amateur Radio Extra Class License · Study Guide as the principal reference in obtaining my Extra-Class License. I was very impressed with both the completeness of the material and the fine way you presented it.

I would certainly recommend it to anyone who was considering studying for the Amateur Extra.

John Ferree W7IYZ
Boise, Idaho

HT-220 PROBLEMS

I have come up with a problem that I hope you can give me some advice on.

About a year ago, my brother and I each purchased an HT-200 "kit" from Spectronics. This kit consisted of the transmitter/receiver PC board, case, battery, and the necessary controls, such as volume and squelch pots.

All we had to do was wire the board into the case, snap in the battery, and away they should go – but not on the desired frequency!!! They have to be padded onto the 146 MHz range as both units appear to be from the hi-hi band, 160–174 MHz.

We wrote both HT-Specialists (Ontario, Can.) and Artic Specialty Co. (Pontiac, Mich.) as they had advertised they were able and willing to do the padding and tune-ups involved. We never heard anything from them so we hunted around for people who either worked for Motorola and could work on them in spare time, or someone with that type of training.

We found two and got *some* work done but for various reasons, they both had to drop the work. This is the point that I'm at now. I just got the two HT's back this morning from the second guy – work not completed, and am stuck with two fully crystalled, dual freq., one watt DEAD 220's.

Can you possibly recommend some firm or person who does these tune-up/padding jobs, short of Motorola (and their $15 per hr. charge)? We have looked around here, but few people have much of a working knowledge of 220's. I would really like to get these radios running because beauties like these shouldn't be lying in a box waiting to be fixed.

I look forward to any advice you can give me, because I've come to the end of my guy wire.

Ken Fowler WA1NSR
E. Middlebury VT

Back before the Standard 146 and Tempo FMH hand units became

generally available, the Motorola HT-220 enjoyed wide favor — since it was essentially the only hand unit available.

There are several drawbacks to the HT's which have encouraged amateurs to go the 146 or FMH route.

For instance there is the matter of the battery. The special batteries for the HT's are quite expensive and difficult to find. In my own experience with a couple of HT's I had to either find Art Housholder (of Spectronics) at a convention with a spare one in his pocket which I could buy or else pay through the nose. The 146 and FMH units use commonly available flashlight battery sized nicads which you can buy at Radio Shack — and at any radio store.

Then there is the problem of service — and it is a serious problem. One of my HT's developed a squeal. I opened it up — froze in horror at the maze of incredibly small parts — and quickly closed it up again. I have been building for years, but I'm not ready to tackle that sort of thing — even if I could find parts for it. I sent it off to Spectronics for repairs — it came back eventually, but still squealed until the day it was stolen. The complaints about HT Specialists kept me from trying them. I didn't know what to do about it except sigh in despair.

With the 146's and the FMH's repair is no problem. Whenever I've had any problems with my 146's I've popped them out to Standard in California and they've come back a few days later all fixed up. They have a number of test benches out there, complete with factory trained servicemen (all amateurs, by the way) who know the Standard units inside and out. I haven't had any problems with the FMH's as yet (no one has dropped them yet), so I haven't any personal experience with the Henry service — but friends say that it is excellent.

The 146 and FMH units are made with small parts, but they are parts that you can walk in and buy — not like some of the micro parts used in the HT's. You need good eyes for the 146 and FMH, not a microscope and the hands of a practiced surgeon.

The 146 has five channels and uses commonly available ($3.75) plug in crystals — the FMH has six channels and uses the same type of inexpensive crystals. Have you priced the precision special crystals used in the HT's? The HT's usually come with one or two channels — so you have maybe 34—94 and 94—94. It is possible to find one with more, but this means you have to have the large (omni) case to hold the crystal switching, which makes the HT almost the size of the 146 and FMH units (same width and thickness, but the HT is about an inch shorter).

One other problem that bothers some operators is the uncertain parentage of many HT's. Since the major market for these units is commercial — the police — FBI — and other agencies which can afford the $800 to $1500 tab for these units — there is a problem wherein it is sometimes difficult for an amateur to know whether his HT has come to him via a legitimate channel or from some clandestine source. Imagine the position of the amateur who goes to a legitimate Motorola repairman with his HT, only to find himself being seriously questioned by the FBI. You wouldn't believe what a complete lack of a sense of humor some of these government agencies can have. I know more than one amateur who is afraid to show his HT where any questions might be asked.

It is nice to have a good idea of just what the price is of your unit too. The 146's and FMH's are advertised and the prices are known. An HT is worth whatever you can get for it, with some going for around $75 and some for ten times that. And what do you do if your HT gets stolen — this has been a serious problem for many amateurs. The 146 and FMH known prices — complete with bona fide sales slip — makes it simple to deal with the insurance company.

If you go the Standard or Tempo route with both hand unit and base or mobile units, you can exchange crystals. I use a Standard in the car as well as the 146's and often I borrow crystals from one for the other. When I'm taking a trip to a distant city I set up the 146 for the local repeaters. This isn't possible with the HT's since the HT crystals normally are soldered in and changing them is a great big difficult deal.

The design of the HT is beautiful — the transmitter is clean — the receiver superb — actually the receiver is a lot better than you need. A two watt hand unit can only transmit so far and it is frustrating to hear a repeater many miles further than you can work with it. Ditto the five watt model HT-220. If Motorola would solve a couple of the simple problems for us the HT's would be a lot more popular. We need available service at ham prices — not $15 per hour commercial service. We need to be able to use inexpensive plug in crystals. We need five or six channels. We need to use inexpensive batteries. How about it, Motorola?

. . .W2NSD/1

REPEATER INFO

Long time since we last wrote to let you know about the FM scene in UK and the rest of Europe. It also gives me the chance to thank you for the copies of 73 (unfortunately postal delays mean that I only received the May copy today).

Since the IARU meeting last May, the FM channels are beginning to get really used on an international basis. The main activity is between 145.500—145.600 at 25 kHz steps.

As to the repeaters, I can only give you definite info on some.

Belgium — 9 ,planned, awaiting licenses.

Czech — 2 FM 600 kHz spaced operating 1—8 kHz wide all mode translator OKØA. Input 145.1 ± 4 kHz, output 145.7 ± 4 kHz.

Denmark — 12 2m & 1 70 cm operational.

Finland — 1 2m in Helsinki this summer.

Germany — on 25 May 1973. 2 2m RTTY relays. 4 2m 600 kHz relays. 78 2m 1.6 MHz relays, 24 70 cm relays.

Norway — NRRL has a plan for 46 repeaters, awaiting licensing.

Sweden — 21 2m repeater licensed (3 in Stockholm).

Switzerland — 2 2m and 6 70 cm relays.

United Kingdom — still only GB3PI 145.15/75 until August 11th and then we will have to wait and see.

Israel — 1 only near Haifa. 145.175/145.775.

So that is how things are on 11 June 1973. At the moment I am editing the first European repeater directory, deadline July 2nd. I'll see if I can get a copy to you on publication.

Kris Partridge G8AUU
Devon, United Kingdom

CONGRATS

Today I took my Novice exam and passed — and I'm holding every one of you personally responsible! In your October issue you advertised a course given at the Hall of Science in New York. I enrolled immediately. Of course I won't know my call letters for a few weeks but I'll let you know what it is as soon as my ticket arrives. Then I'll really feel like a member of the 73 family of radio amateurs.

Irene Jean Putzer
Brooklyn NY

MANUAL NEEDED

I am hoping your readers can help me. I recently acquired a Delcon Linear Amplifier T210. I would like to know where I could get a manual for this item. I have just the amplifier and will need to build the power supply. I also need to know the type of tubes that it takes. The Delcon Corporation was located in Palo Alto, California.

Rudolf Birkenkopt DA1RB/WB2XCS
EES PX, Patch Barracks
APO New York 09131

BULLETIN

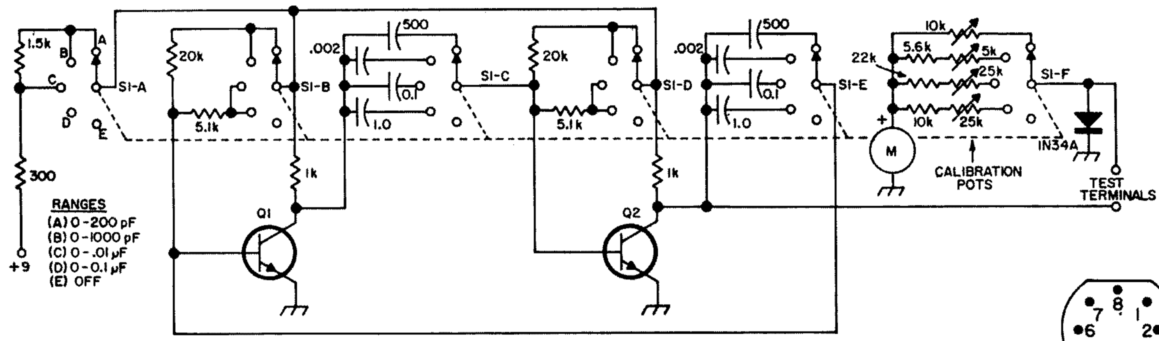
I am a regular reader of the Repeater Bulletin and quite active on 2 meter FM. I think the Bulletin excellent and I have always enjoyed the issues of 73 I have picked off the newsstand so much, that I thought it was high time I subscribed.

B. Robert Benson VE2VW
Montreal, Que.

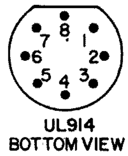
CIRCUITS, CIRCUITS, CIRCUITS...

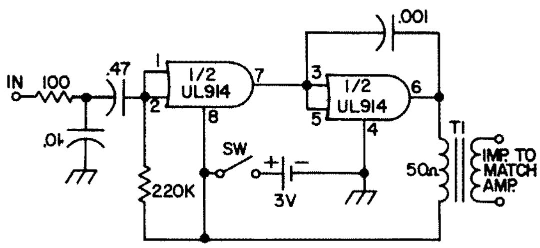
The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.

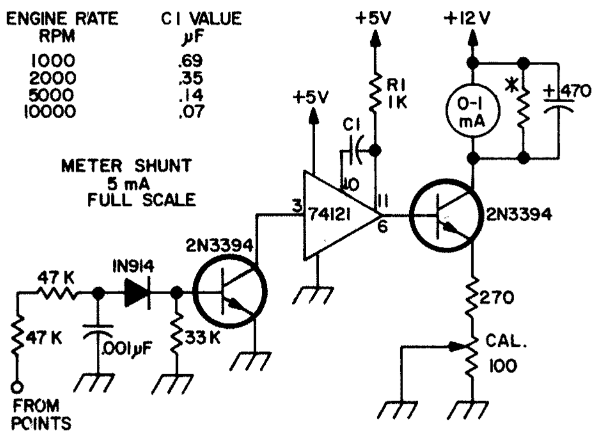


Although this capacitance meter will not measure electrolytic capacitors, it will measure any other type from zero to 0.1 µF with reasonable accuracy. On the lower end 4 pF can be read accurately and 2 pF easily estimated. Transistors Q1 and Q2 are 2N168, 2N1605, 2N2926, SK3011 or HEP-54; the meter is a 0–50 microampere unit and the range switch a Centralab PA1021.

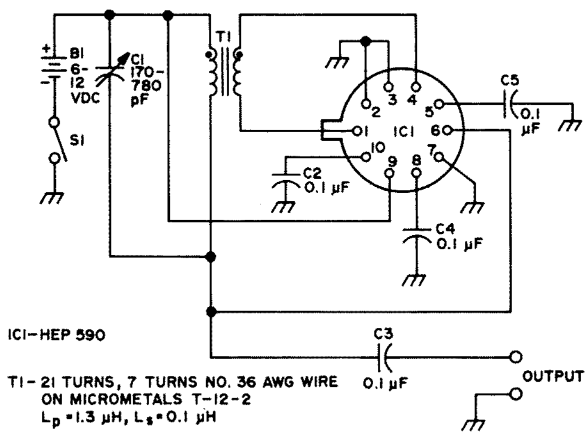




A mike or phono amp using the UL914. Since the power requirements are minimal this is a good circuit to mount right in the microphone case along with two tiny batteries. Thanks to K5ITE.



An IC tachometer that is adaptable, by changing C1, to different rpm rates. In the event there is no other tachometer handy with which to calibrate the unit, temporarily disconnect the three components at the cathode of the 1N914 and connect it to a signal generator through a 5.6k resistor. From "Handbook of IC Circuit Projects," by Tab Books.



5–10 MHz VFO or 40 meter QRP transmitter; an idea for those backwoods hikes. Courtesy Motorola HMA36, IC Projects for Amateurs.

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August 1973

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AUSTRALIA	14	14	14	7B	7B	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7	7	7	7	7	14	14	14	14	14A
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PHILIPPINES	14	14	7A	7B	7B	7B	7B	7	7	7	7A	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	14	14	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	7	7A	14	14	14	7B

WESTERN UNITED STATES TO:

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PHILIPPINES	14	14	14	14	7B	7V	7	7	7	7	14	14
PUERTO RICO	14	14	7	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	7B	7B	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	7B
EAST COAST	14	14	7	7	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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September 1973
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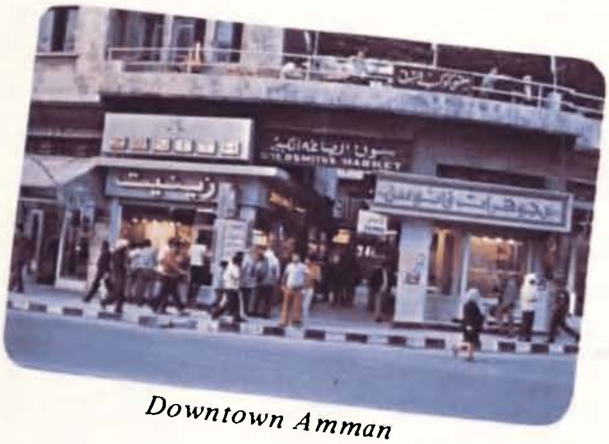
73 magazine
for radio amateurs

JORDAN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The desert of Jordan


Amphitheater at Jarash


Eating on Syria-Israel-Jordan border.

- Repeater Logic System
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more . . .more . . . more . . .

73 magazine
for radio amateurs

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COVERS: A few of the hundreds of slides taken during the recent Jordan visit by our editor are on the covers. More exhaustive groups of slides will be shown at hamfests and conventions. Or, better yet, how about joining the 73 Journey to Jordan next March? That'll be a DXpedition you'll never forget!

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A. *Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.*

Amateur Radio

SEPTEMBER MCMLXXIII Monthly Ham

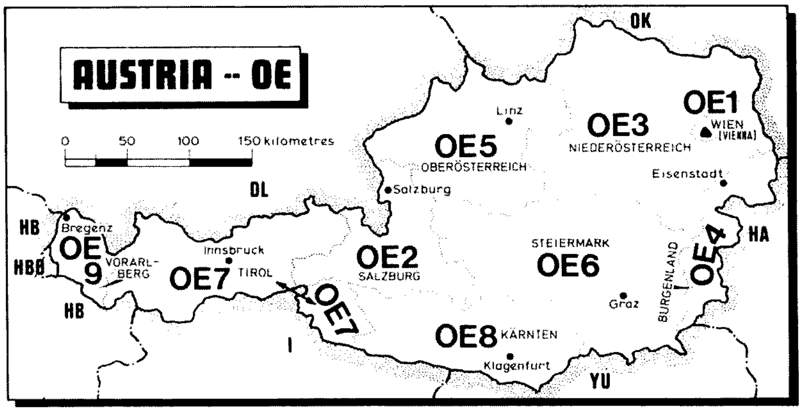
CLEGG BOOSTS 220 VIA REPEATER LEASING

A new 220 MHz repeater program has just been announced by Clegg, Lancaster, Pennsylvania, in an effort to bring vigorous 220 activity to radio amateurs from coast to coast.

A new Clegg repeater, valued at approximately $1,200.00, will now be leased to amateurs at special club rates of only $25.00 per month. The low monthly rental fee can be further reduced with club member purchases of the FM-21 transceiver, a 220 MHz FM unit.

The repeater is leased complete (except antennae and feed line) with features that include automatic identification, all solid-state construction, and built-in timers. It operates at 10 to 15 watts, uses a Phelps-Dodge duplexer, and has approximately .4 μV sensitivity. It includes an ac supply, local MIC, and metered signal strength.

All amateur radio clubs are invited to contact the Clegg Division if interested in getting their club into the repeater program. They may write Phil Theis K3TUF, Clegg Division, International Signal and Control Corporation, 3050 Hempland Road, Lancaster, Pennsylvania 17601, or telephone him at (717) 299-3671 for more information.



RECIPROCAL LICENSING IN ISRAEL

Every radio amateur who presents a valid license from his own country can receive an Israeli license. At the time of government examinations, he will be questioned in those specific areas where it is felt that the technical level in his own country is lower than in Israel. Decisions regarding the technical levels will be based upon a comparison of the syllabus from the amateur's own country to the syllabus in Israel. An amateur who does not pass the examination, or decides not to sit for it, will automatically be issued an Israeli license that is one grade lower than his original license. Examinations are currently held in Israel twice a year during the school vacations of the holidays Passover and Rosh Hashana (the Jewish New Year).

In the case of the U.S., Canada, UK, Austria and Costa Rica, special reciprocal licensing agreements exist. Amateurs from these countries may receive licenses during the period of their stay in Israel, and they are not required to sit for any examinations.

Amateurs who do not bring equipment can receive permission to operate every amateur station in Israel as second operators.

Further information, application forms for reciprocal licenses, may be obtained from: Ministry of Communications, Engineering Services, Postbox 29107, Tel-Aviv, Israel.

AC3 - NEXT YEAR?

From The Camel Drivers Newsletter.

Arne 1AH relates his personal expedition to visit the Kingdom of Sikkim (north of northeast India and east of Nepal) where he had an invitation to set up a transmitting station with an AC3 call for the DX hounds early in April. Traveling in his own Volvo station wagon with his family, he took one day to reach Lahore, another to Delhi, and then two days to Gantok, the capitol of Sikkim. Sounds easy, but it wasn't! He'd applied to the Sikkim Government for permission to operate about six weeks before starting out, and tarried long enough in Delhi to make an application to operate through the Ministry of Foreign Affairs. Actually the second day's journey out of Delhi only got him to the Sikkim border, and he stayed in Siliguri, about 800 km from Delhi. Early the next morning, it was a three hour drive to Gantok, and he was pleasantly surprised to find many military trucks escorting him along, until he began to meet hundreds of demonstrators who weren't greeting him! His arrival in Gantok coincided with a downpour of monsoon rains, which helped break up the demonstrating throngs so he could locate the traveler's bungalow that had been arranged for him previously by a friend in Kabul. The first two days were spent in fruitless efforts to get operating, but there was so much turmoil it was hopeless. Then Indian troops arrived at the request of the government and some order was restored – at least he was able to see an Indian Political officer, who refused a permit to operate but cheerfully promised that if Arne came back "next year" all would be serene and he could operate then.

All was not lost however, as the next day Arne went to see a chap named Oberoi, a very close friend of the King. He spent the balance of his four days in Sikkim sightseeing, which was very worthwhile, as it is a beautiful country. There is no airport in Sikkim – all access is by road from India. Early in the morning Arne and his family started back for the Indian

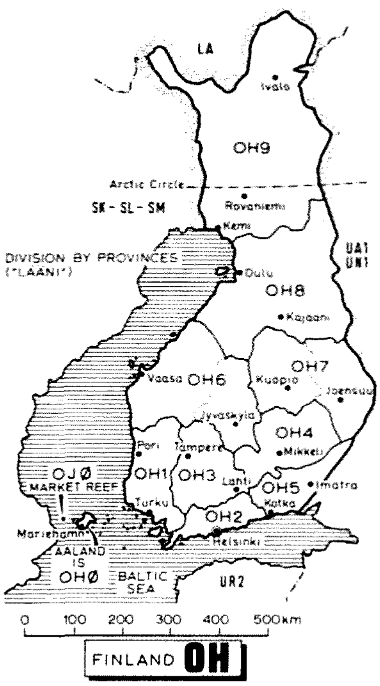
border, and at Singtam, the last town in Sikkim, they ran into a roadblock at 7 a.m. – trees, rocks, and people. The leader wanted to know why Arne was going to India – if he was a friend of the King – complimented him on his car – and continued a long discussion before requiring the car and baggage to be opened for inspection. After all the ruckus of the past four days, this last straw unnerved Ula, Arne's XYL, and the tears started to flow (and yours would too, with about 20,000 demonstrators around the car with knives, sticks, and rocks), but the tears worked, and they were quickly cleared to proceed -- gratefully! The trip was interesting, and good pre-planning such as an extra fuel tank made the trip relatively comfortable. He did get stuck twice in the desert, but Scandinavian resourcefulness in using the rubber floor mat out of the car provided the traction needed! These expeditions are usually fun, but such a frustrating one as Arne's is better done when there isn't a political upheaval at the destination!

SHORT WAVE...

SHORT CIRCUITS!

From The Short Wave Magazine, May, 1973.

From G2BVN's Region I News for April we get it that if and when amateur licenses are in general issue to Chinese nationals, the form of the call sign will be B followed by a letter denoting a geographical area, then a single digit and after that an A, or A with one or two suffix letters, e.g., a Chinese amateur station in the Shanghai area could be signing BH2A, or if from Hankow BJ1AB, while a Sinkiang AT-station might come up as, say, BU3ABC. There are 17 prefix letters allotted. So, when the bamboo curtain does go up (the chinks are already beginning to show) and amateur licenses become freely available, the Chinese call book will be quite a thing. Though at the moment of writing we have no further positive information, call signs heard or worked in the form shown here could well be genuine.



CANADIAN RTTY NET

The canadian Amateur Radio Teletype Group has inaugurated a national RTTY traffic net and bulletin service.

Operation is on 14.08 MHz every Sunday at 1930 GMT with VE5KE as net control station. .... CARF

HAM OF THE YEAR - 1973

The Federation of Eastern Massachusetts Amateur Radio Associations are now requesting nominations for the "Ham of the Year" award for 1973. Only amateurs in the 1st call district are eligible and the amateur selected will be the top "good neighbor" among hams, the one who has performed an outstanding public service.

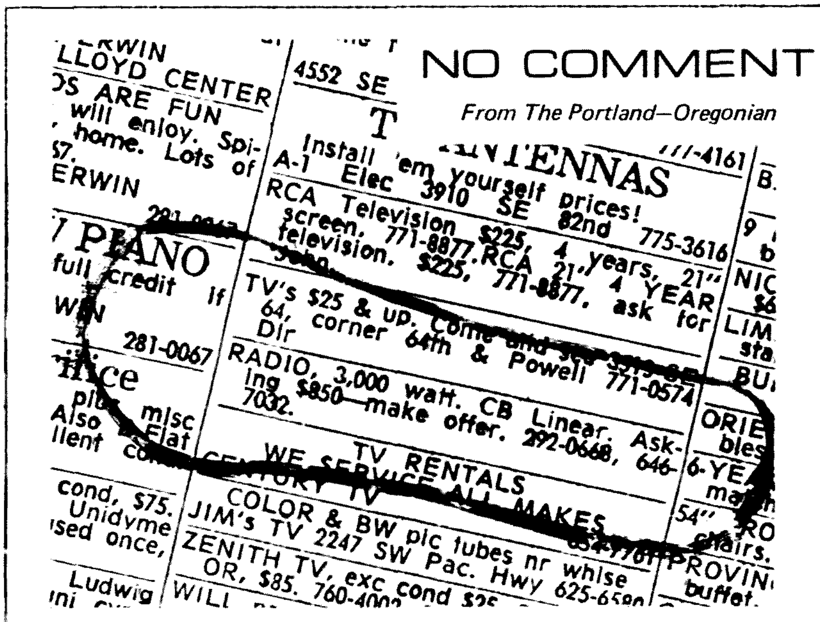
Anyone may nominate an amateur radio operator for the honor. Winner of the award will be chosen for the amateur activity which brings the greatest benefit to an individual or group and for the amount of ingenuity and personal sacrifice displayed in performing the service.

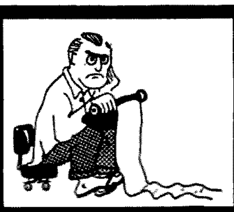
Nominating letters should include the candidate's name, address, call letters and a complete description of the service performed. Letters must be sent to the Chairman of the FEMARA Awards Committee, 28 Forest Ave., Swampscott, Mass. 01907.

The winner will be presented with a plaque and a cash award at the ARRL New England Convention, Dunfey's Hyannis, Cape Cod, on September 29, 1973.

NO COMMENT

From The Portland—Oregonian





NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

MORE ARGUMENT

The more I think about Walker and his constant accusations of appliance operation, the more irritated I get – the gall of that man – and the incredible myopia for someone in a position of responsibility and trust. Amateurs have had to sit through his arrogant calumnous vitriolic attacks at convention after convention – and the worst part is that they are totally without foundation.

Let's take a look at the facts of the situation. Okay, one fact is that in the golden days of yore, amateurs did indeed build their transmitters – no doubt about that – because there were none available to buy commercially. However, in those wonderful years that bring tears of nostalgia to the old timers, the great 30's, amateurs did not build their receivers. Hallicrafters, National, Bretting, and many others took care of that.

Before you join the aged in awe of the skill demonstrated in building those transmitters you'd better take a good look at the amateur radio magazines of the 30's and the transmitters they were building – you'll get a good laugh. One hundred watts was pretty high power then, and the most popular rigs being built were the QSL-40 jobs with a chassis the size of a QSL card and forty powerful CW watts input to a 6L6G. The "G" tube was better so you could see how red the plate was getting when you held the key down. Heady stuff.

Most Novices today build equipment that is far more complicated.

Please dig out any of the 30's ham magazines and see for yourself – then put it against a current issue of 73 and compare the construction projects – the number of pages of ads for parts – and the kits available.

Speaking of kits, which compnay in the ham field is the biggest – by a wide margin today? You know the answer is Heath – with somewhere between one half and one third of the ham market. Can you find an amateur anywhere (outside of those nostalgic old timers) who does not have some Heath gear around which he has built? The only difference is that the Heath gear of today is exceedingly more complicated than the transmitters our senior citizens were putting together forty years ago. You just try your hand at the Heath FM rig and see if you don't start to sweat. It's a nice rig, for sure, but you'll know you've had a workout by the time you get done.

Is there any real difference between taking a list of parts in a magazine to the radio store and going home with the bag – and sending to Heath for the bag? Well, you don't have to drill and punch out all those holes, for one thing – is that the thing that makes us appliance operators now – we dont't punch out tube socket holes anymore?

No, when Heath is selling kits to virtually every active ham – when there are more Heath transmitters on the air than Hallicrafters, National, Drake, Swan, SBE, etc., combined, then how can someone like Walker get up in front of us and point the finger of shame at us appliance operators?

Mr. Walker, for heaven's sakes open your eyes and take a good look! Get on the phone bands where 99% of the active amateurs are today and talk with them – find out what is happening – talk with the unwashed multitudes – come out of that Extra Class wasteland the FCC has created and get some grass roots data. The ham world is not Collins. Get on two meters and learn to talk with the fellows operating there – they are darned nice guys – and they are building some of the most sophisticated equipment around for repeater controls. Join in some of the slow scan activity on twenty and see for yourself what is really happening. Work some DX. You might even try six meters – there is a whole bunch of fellows on that band that you haven't ever met or talked with – and you'll find that they, like all the rest of us, have been building.

KC Update

The item in the July issue (page 94) regarding the shutting down of a KC repeater has brought mixed mail – some saying the report we received was without substance – others that the report will undoubtedly keep the repeater from ever being licensed.

(Continued on p. 84)

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	
Technician Class	50.100 – 54.000, 145.000–148.000, 220 MHz band and above.	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License .... $ 9
Renewal .... $ 9
New Class .... $ 9
Modification .... $ 4
Special Call Sign $25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

RECIPROCAL LICENSING Between U.S. and: CE - CP - CT1 - CX - D - EI - F - G - HB9 - HC - HI - HK - HP - HR - LA - LX - OA - OH - PA - PY - SM - TG - TI - VE - VR2 - VU - YB - YN - YS - YV - ZL - ZP - 3A - 4X - 6Y - 8P - 9K - 9L - 9Y.

THIRD PARTY AGREEMENTS Between U.S. and: CE - CM - CO - CP - CX - EL - HC - HH - HI - HK - HR - JY - LU - OA - PY - TG - TI - VE - VO - XE - XP - YN - YS - YV - ZP - 4X - 4Z - 8R - 9Y. Also W/K/8P.

RESTRICTED COUNTRIES (don't work) are now down to only Vietnam(s) 3W8 and XV, with the exception of XV5AC being okay.

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

A leading topic among Slow Scanners is scan conversion, or scan converter units. Here two basic techniques are possible. Digital IC circuits may be utilized to convert a TV signal into bits of information that are then "written" into an IC memory unit at one scan rate, and "read" out of the memory unit at another scan rate. Naturally, this "digitalized TV information" method can be designed to convert any desired scan rate – fast to slow, or slow to fast. K7YZZ, WØLMD, W6MXV and possibly some others are presently working on this type fast to Slow Scan converters, and the results I've seen have been very good.

The other method of scan conversion employs scan converter tubes. These are specially manufactured face-to-face "vidicons" sharing a common target (sketch in Fig. 1). One end acts like a CRT, projecting a picture on the storage target, while the other end independently scans this stored image, similar to conventional TV camera methods. Now we can feed a

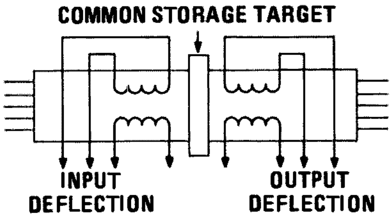


Fig. 1. A "face to face" vidicon for scan rate conversion.

picture of one scan rate in one "vidicon" (side) and output this at another scanning rate on the other side. W9NTP and SMØBUO are working on a converter like this as a joint project. Don displayed his Slow to Fast Scan converter this year at Dayton. The unit used a Thompson TME 1238 single gun storage vidicon (French made) and converted Slow Scan to Fast Scan. The picture was displayed on a regular TV. Results were good under the circumstances. Don threw (literally!) the unit together right before Dayton and didn't have time to work out a few bugs (noise in video). By now the unit is probably working perfectly.

J&R have been quite busy lately. Their gear now boasts optional oak wood cabinets or conventional Heath-style cabinets. No difference in price for either cabinet. Another change is the 8NP7 crt in the monitor. Since approximately 4½ inches square of the screen is used and the "bell" is aluminized, the pictures are fairly bright. In fact, the intensity can be high and "blooming" of whites is extremely low. (This clever idea might help some of you with adapters and scopes that use crt's without accelerators. Instead of using all 5 inches of the screen, lower the horizontal and vertical size pots to display only a 3 inch square picture . . . brighter, eh?) It's difficult to improve on circuitry like the 'mxv monitor, and it's good to see J&R hasn't made any radical changes here.

Their low light level camera does a superb job, even with average room light. Also, the automatic light compensation is nice when working with differently illuminated scenes. Very good definition is accomplished, probably due to the elaborate sampling method used. The camera also included ¼ frame scan, video inverter, built-in gray scale (flip and it's even in the middle of your picture . . . for proper light level calibration) and built-in power supply. Very nice gear.

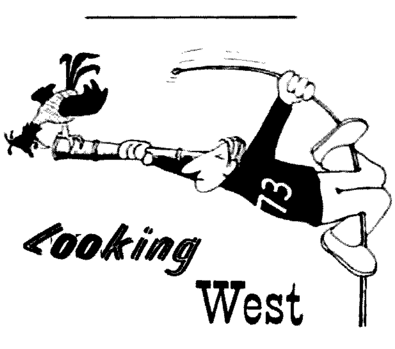
Investigation is presently being conducted on replacements for the only electron tubes necessary in modern TV gear; the camera pickup tube and the cathode ray (picture) tube. One example is the recently introduced surface charge transistor (which may prove quite interesting in Slow Scan applications). This microminiature light-sensitive semiconductor device is being considered for use as solid state fast scan camera "tubes," using a computer-manufactured "string" of these to make up 252 lines, and scanning through this matrix with digital logic circuits. Slow Scan would be a natural here, since only a small 120 line matrix would be required, and conventional circuitry could be used (no sampling techniques or deflection yokes, either). Watch for more info on these sct's soon. Also, plasma panels (those ¼ million neon lamp panels) can be used to replace picture tubes in basically the same way. A Slow Scan monitor, interfaced with a plasma panel unit encoder, can scan through these lamps, thus reproducing the SSTV picture. WØLMD is presently investigating the plasma panel display concept.

How many of you DX operators would like to get in on the action of Slow Scan? Suppose a U.S. station made you a tape to transmit over your rig (of pictures, sketches, ID's, etc. you send him). Another Slow Scan station with a SSTV to Polaroid setup could take your "received off the air" tapes and send the confirmation photos back to you. You gain Slow Scan QSO's, others gain a new country on Slow Scan. This column can serve as a central point to get the idea going. If you can help make tapes or photos from a monitor, let me know. Likewise, interested DX stations let me know! I'll put you in touch and we will include a list of the groups in this column. Why don't you interested DX ops drop Wayne W2NSD/1 or me a letter explaining your rig, customs problems, postal procedure, etc., and let's see if we can't get you on SSTV.

We hope soon to have photos from VK5BS after his Fiji trip. (Maybe he can also convince them to try SSTV!) Incidentally, Australia's foremost SSTV group, the Eastern and Mountain Radio Club (John VK3LM, president) gathers Sundays at 0100 GMT on 14.230 kHz for their SSTV net.

Quite a few of the Slow Scan gang are presently setting up to copy pictures from our weather satellites. Facsimile communication is just interesting enough to catch Slow Scanners' fancy as a nice sideline. Basically, this consists of connecting a slightly modified fax machine (like those surplus desk fax units) to a receiver tuned to the satellite. The satellites operate around 136 MHz. A high gain directional antenna, like a helical, and pre-amp, finishes off the setup. Of course, there are problems, like Doppler shift, etc., (30 kHz bandwidth best) but one should still get fair results using a repeaked 2 meter rig, like maybe a TR-22. Info is still rather scarce on this, and some of the fellows working on it (WA7MOV, WØOQC, W7FEN and WB8DQT) may be too busy for much correspondence. Hopefully, by the time this appears in print, I will have copies of your info. (Plus a satellite monitor going myself!) If you're anxious for more info, drop me a note and SASE, and I'll try to help you.

K4TWJ



Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

FCC CRACKDOWN

The headline in the Van Nuys News of Tuesday, June 26, 1973, just about

blew my mind. It read "U.S. Raids Radio Operators on Citizens Band in Valley." Mr. Jeffrey B. Young, who supervises the FCC special enforcement facility in Santa Ana, disclosed today that his agency had spent June 20 to 25 monitoring CB activity here in the valley, "raided" some 60 stations and had found that some forty of these were in violation of the rules. Mr. Young told the press that while no formal written notices have been issued at this time, violators have been verbally informed of their violations, and that formal written notices will be issued within a month. Most will be cited for failure to properly identify call sign, failure to observe the 5-minute time limitation on transmission, over-height antennas and of course running a bit over the power limit.

In case you are wondering what action the Commission can take in these cases here is the answer according to Mr. Young. Licensed violators face up to a $500 fine and revocation of their license. As to the unlicensed variety (about one-third of those caught fell into that category), they face action by both the Justice Department and the FBI, if the Commission chooses to turn the matter over to them. It is interesting to note that the crackdown is a direct result of complaints from the general public about excessive TVI problems and from legal users of CB who were sick and tired of the abuse they were suffering at the hands of the multitude of illegal operators. I was also gratified that Anne Hilker, author of the article in the newpaper, went to the trouble of explaining that it was Citizens Band operatiors, not hams, who were the source of the problem and subsequent investigation. She is to be commended for a good job of accurate reporting.

Many of us are equipped to track down "hidden transmitters" and still others own CB radios. Let the FCC know about violations in your area. According to Mr. Young, the crackdown out here is part of a nationwide effort to rid CB of those who would abuse the privilege. Hopefully in the near future "Monkey Man," "Fisherman," and their cronies will be part of the past.

220 Report

The Southern California Repeater Association held its meeting in Anaheim June 30th, and announced its proposed 200 band plan. Here is the way they have opted to go, as reported by Dave Glawson WA5CGR, with fills from Dick W6OLD, who covered the meeting while I was busy at the salt mines.

220.00 to 220.30 allocated to CW, AM, SSB, EME, DX.
220.30 to 222.00 allocated to remote control and aux-links for repeaters.
222.30 to 223.40 allocated to repeater inputs.
223.40 to 223.90 allocated to FM simplex.
223.90 to 225.00 allocated to repeater outputs.

Repeaters will use a 1.6 MHz split with an initital 40 kHz separation. However, it was also adopted that separation will be split to 20 kHz if there is a large demand for repeater channels. It is hoped that manufacturers will note this and design equipment that will work well, using the aforementioned 20 kHz separation.

Northern California

Up to this time, LW has concentrated on the area in and around Los Angeles. Now, through the efforts of Jerry Walker WA6LLX, LW can bring you some information on what's taking place up north. The following is an excerpt from a recent letter:

"Coordination is by the California Amateur Relay Council, Northern Section. The CARC is well thought of in the north and the coordination efforts are supported by member and non-member repeater groups alike. Location, power, expected coverage, possible mix frequencies and feelings of adjacent channel users are all considered before frequencies are recommended. The CARC North has a couple of things going for them in this effort. Northern California FM started out repeater-oriented as opposed to the south which began remote-base oriented, and repeater growth has been slow enough to allow a complex coordination effort to work.

Twenty-four hour operation is practically non-existent. Most repeaters operate only when a licensed control point is available to monitor. This limits most operation from about 6 a.m. to midnight. Most 34–94 repeaters are 24-hour operations, serving as calling and traffic signals.

Repeaters I found particularly friendly are WB6TSO (22/82) St. Louis Obispo, WB6AAE (22/82) S.F.–Oakland, and WB6ZTA (34/97) Lake Berryessa, north of S.F. Bay. ZTA has exceptional coverage across the Sacramento Valley and into the Sierra along I-80. K6GWE will soon operate from the top of Mt. Tamalpias in Marin County and should do exceptionally well."

LW would like to hear from others in Northern California, so get out those typewriters and send me some info.

WA2HVK/6

AMSAT NEWS

OSCAR 6

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Oscar 6 now has no less than five operating awards that are being offered for satellite work. They are in order of difficulty:
Satellite Communicators Club
WVE Satellite AWARD
Satellite DX Achievement Award
OSCAR 6 WAS (Worked All States)
GO DX Award OSCAR Endorsement

Oscar 6 has been a great success in many fields and has contributed much in the way of space research. One of these new finds has been christened "INVERTED DOPPLER." More will be discussed about this subject later.

Marc Pressman WB4DRB, has developed a computerized AMSAT OSCAR 6 Communications Information Retrieval System which lists participating stations, states, and countries that use OSCAR 6. You are invited to send your lists to AMSAT so they can keep an up to date record of QSO's through OSCAR 6. Reports from stations in IARU Regions 1 and 3 are particularly needed.

AMSAT NETS

East Coast 75m AMSAT Net
Mondays 9:00 p.m. PDT (0300 Z Tuesday), 3850 kHz, Net Control, W6DMN or W6BGJ
International 20m AMSAT Net
Sunday 1800 Z, 14280 kHz, Net Control: W3ZM or others
International 15m AMSAT Net
Sundays 1900 Z, 21,280 kHz, Net Control: W3ZM or others
European 40m OSCAR 6 Net
Sundays 0930 Z, 7070 kHz
European 80m OSCAR 6 Net
After Passes on ON days, 3780 kHz

In addition, the frequencies 3855 kHz and 14,280 kHz are being used as general watch frequencies for satellite information after passes.

In the Washington area AMSAT traffic is handled via 2m FM on 146.85 MHz simplex and through the AMSAT repeater 146.25/146.85 MHz. Those interested in satellites in other parts of the country are urged to use these same frequency combinations where possible. If a repeater is already on 25/85, get on it. If not, try to set one up or use 146.85 simplex. This

way we can all communicate more easily among each other when traveling.

The regular operating schedule of OSCAR 6 is now as follows:

ON — Available for two-way contacts; 0000 Z - 2400 Z Thursdays, Saturdays and Mondays.

OFF — or if ON, not available for two-way contacts: 0000 Z - 2400 Z Fridays, Sundays, Tuesdays and Wednesdays.

ON — not available for two-way contacts for about three minutes approximately ten minutes after the first ascending node (N-S equatorial crossing) on each scheduled OFF day.

This operation is for the purpose ot collecting telemetry data. Those copying telemetry data at any time are urged to send the *raw* numbers to: AMSAT Telemetry Data Dept., P. O. Box 27, Washington, D. C., 20044, USA.

Modifications to this schedule will be made should it become necessary or if special operating situations make it desirable. Also, the operating schedule may be extended for DXpeditions and other worthy causes.

Word on schedule changes and other pertinent data can be obtained from any of the following sources:

AMSAT Nets, see above
AMSAT Hot-Line (301-654-1166)
W1AW Bulletins
AMSAT Bulletin Stations VE2BYG, KLHTV, W3TMZ and K7BBO. (These stations transmit on the Satellite on about 29,500 kHz on the reference orbits.) A reference orbit is the first orbit of each Greenwich day, the same orbit during which the satellite is turned ON briefly for telemetry recordings on OFF days.

ORBITAL INFORMATION

REV	DATE	TIME Z	LONG W
4012	Sept 1	o147.5	74.3
4024	Sept 2	0047.5	59.3
4037	Sept 3	0142.4	73.0
4049	Sept 4	0042.3	58.0
4062	Sept 5	0137.3	71.7
4074	Sept 6	0037.2	71.7
4087	Sept 7	0132.1	70.5
4112	Sept 9	0127.0	69.2
4124	Sept 10	0026.9	54.2
4137	Sept 11	0121.8	67.9
4149	Sept 12	0021.8	52.9
4162	Sept 13	0116.7	66.6
4174	Sept 14	0016.6	51.6
4187	Sept 15	0111.6	65.3
4199	Sept 16	0011.5	50.3
4212	Sept 17	0106.4	64.0
4224	Sept 18	0006.3	49.0
4237	Sept 19	0101.3	62.7
4249	Sept 20	0001.2	47.7
4262	Sept 21	0056.1	61.5
4275	Sept 22	0151.1	75.2
4287	Sept 23	0051.0	00.2
4300	Sept 24	0145.9	73.9
4325	Sept 26	0140.8	72.6
4337	Sept 27	0040.7	57.6
4350	Sept 28	0135.6	71.3
4362	Sept 29	0035.6	56.3
4375	Sept 30	0130.5	70.1

. . .WB8LBP

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

WB5CHN of Duncanville, Texas ays the DX season started slowly from that area with the only "real DX" being KP4DKE and KP4AHQ. Things were not all bad for Jim, he did manage to work Mississippi for state #47 leaving only KH6, KL7 and Idaho for WAS. I heard Jim on the air since receiving his letter and found he was sporting a linear of the type in the July 1969 issue of 73. It sounded great here and brought the signal up about 12 db. . . Wayne WB9IHE writes from Fairview Heights, Illinois to say he worked two openings June 27th, one to Arizona (WA7RRT and W7LED) and another to the East coast. Wayne runs a TR-106 to stacked 3 element beams. . .you will find him around 50.4. . .WB9AYO, Bob, is a neighbor in Collinsville, Illinois. . .Bob is getting set up for 6 Meter CW and is interested in working some Aurora. If he is not careful K9YNN, W9EVD and WB9JGR from his area will beat him to the punch. . .WA2JQD is now WB4EQO and has worked 40 states in 3 weeks with the new call. . .WØNRI worked Vermont (WA1JEX) for state number 50. WB6NKO made the magic 50 too, working Maine (WA1EXN). Congratulations to both on accomplishing what to most of us is an impossible task. WA1EXN must hold the record for completing WAS for others. . .he will have some help in the future, W1YTW and WA1OJB have been active from Maine in the past weeks. . .W2IDZ was most amazed when I told him the "Lil Lulu" transmitter he designed 15 or so years ago was being sold in kit form by one of the big surplus houses. . .W4GDS mentioned hearing many South American commercial signals below 50 MHz but no sign of amateur activity . . .I had a nice crossmode QSO with Bruce WA2KJJ. He copied my SSB better, I copied his Clegg 99'er better on my AM transceiver. . .W1GAO says the Boston area had excellent double-hop openings during late June. Kevin worked W7FN, K6GHC and a host of others from Seattle to Southern California. . .WA5MZW (Bill) and WB5DKG (Ruth) were married June 23rd, WB5CTS and WB5DSH were groomsmen. . .passed along by Art WA1EXN who also mentions having worked 8P6EN July 8th and 21 days of Es during June. Art recently received an award, a photograph of which I hope to be able to publish next month. . .Forrest K4YPO says he worked 10 states in one evening with his New SBE SB-50, not bad for 10 Watts. . .Wally WA2BLM, who also signs WA1IWK and WB4MZN, is putting up 11 elements on a 47' boom and hopes to have it operational for the September Sweepstakes. . .this is from the Bridgeport, t, Vermont QTH. . .The rig is s Swan 250C. Those needing Vermont please take note.

Karl Braun, Bauvereinstrasse 41-45, D-8500 Nuernberg, Germany, manufacturers a 6 Meter converter, the model DGTC26, even though 50MHz is not allotted to the amateur service in Germany. With the almost total lack of converters "Made in USA" perhaps some readers would be interested in this unit. The DGTC26 measures 10 x 5 x 2.5cm and weighs about 70 grams. The input and output impedances are 50-75 Ohms and the i-F is 28-32 MHz. 12 V at 25 mA provide 25 dB gain at a noise figure of less than 3 dB. The circuit consists of two RCA 40673's (dual-gate MOS-FET) as RF and mixer with a bipolar oscillator. Zener regulation is also provided. The price is DM 122 or about $38 at the exchange rate prevailing at the time of this writing.

Several columns ago reference was made to a letter received from Geoff Wilson-VK3AMK. Geoff explained the 6 Meter situation in VK land quite well and I still intend to publish this letter in a future column. The problem has been the Es season. So much has been happening of late that there simply has not been enough space to give this letter justice. When the Es dies a little we will run the whole letter. The same situation described above holds true for several other items. All will make good reading on a cold winter night.

WAØABI

IQNLSIY VJSNR USMR

GRCCTYRC KSNL

GSCNRTMC!

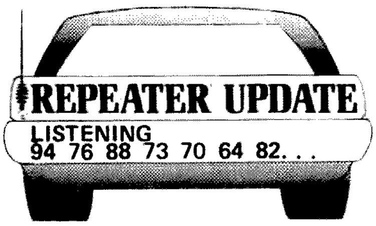
73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

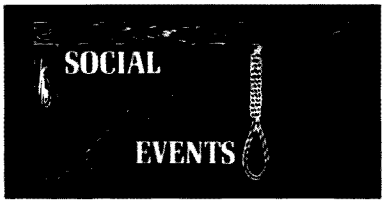
REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS



You're missing half of the ballgame if your name isn't on the program . . . KEEP THOSE UPDATES COMING!!

AZ	WR7ABH	TUCSON		146.26-146.86
CA	WR6AAA	CATALINA IS.		147.67-147.09
CA	WR6AAC/6	L. A.		146.37-146.97
CA	WR6AAD	OAKLAND		147.96-147.36
CA	WR6AAE	OAKLAND		146.22-146.82
CA	WR6AAB	L. A.		146.01-146.61
CA	WR6ABC	CLOSED		
CA	WR6ABD	SAN JOSE		146.04-146.64
CA	WR6ABE	MT. WILSON		147.435-146.40
CA	WR6ABJ	L. A.		146.07-146.67
CA	WR6ABM	OAKLAND		146.22-146.82
CA	WR6ABN	MT. LEE		147.84-147.24
CA	WR6ABQ	MT. DISAPPOINTMENT		147.87-147.27
CT	WR1AAE	LITCHFIELD		147.76-146.76
CT	WR1AAF	OXFORD		147.49-146.49
CT	WR1ABD	GROTON		146.87-146.67
CT	WR1ABE	BRIDGEPORT		146.295-146.895
CT	WR1ARM	AVON		146.28-146.88
CT	WR1ABT	NEW HAVEN		146.01-146.61
GA	WR4AAE	ATLANTA		146.22-146.82
GA	WR4ABC	ATLANTA		146.37-146.97
GA	WR4ABD	MABLETON		146.13-146.73
IA	WRØABO	DUBUQUE		146.34-146.94
ID	WR7ABA	BOISE		146.28-146.86
IL	WR9AAA	JOLIET		146.28-146.86
IL	WR9AAD	MURPHYSBORO		146.25-146.85
IL	WR9ABB	HINSDALE	PL 107.2	146.07-146.67
IL	WR8ABH	WESTERN SPRINGS		223.30-224.90
IN	WR9AAC	FT. WAYNE		146.26-146.86
KS	WRØABB	WICHITA		146.22-146.82
KS	WRØABK	WICHITA		146.34-146.94
KY	WR4ABD	MURRAY		146.34-146.94
MA	WR1AAA	MALDEN		146.31-146.91
MA	WR1AAC	SALEM		146.26-146.68
MA	WR1AAH	MARLBORO		146.01-146.61
MA	WR1ABB	FRAMINGHAM		147.75-147.15
MA	WR1ABG	WEBSTER		146.28-146.86
MA	WR1ABI	FALL RIVER		52.018-52.700
MA	WR1ABJ	WESTON		146.26-146.86
MA	WR1ABN	WALPOLE		147.49-147.09
MA	WR1ABP	BILLERICA		147.72-147.12
MD	WR3ABB	GREENBELT		146.26-146.88
MD	WR3ABC	CHEVERLY		146.01-146.61
MI	WRØAAA	MILFORD		146.19-146.79
MI	WR6ABI	KALAMAZOO	T2100	146.34-146.94
MO	WRØABH	ST. LOUIS		146.26-146.86
MO	WRØABI	SAVANNAH		146.25-146.85
				146.10-146.65
NC	WR4AAA	SALISBURY		146.28-146.88
NC	WR4ABF	SHELBY		146.28-146.86
NC	WR4ABK	CHARLOTTE		146.16-146.76
NC	WR4ABL	GREENSBORO		146.16-146.76
NC	WR4ABP	GRIFTON		146.16-146.76
NC	WR4ABT	CHARLOTTE		146.26-146.86
NC	WR4ABX	LEXINGTON		146.31-146.91
NC	WR4ABY	HENDERSONVILLE		146.04-146.64
NC	WR4ACA	WINSTON-SALEM		146.04-146.64
NC	WR4ACF	RALEIGH		146.04-146.64
NH	WR1AAB	PETERBOROUGH		146.19-146.79
				222.34-223.94
				444.10-449.10
NH	WR1ABQ	DERRY		146.25-146.85
NH	WR1ABU	CONCORD		146.34-146.94
NJ	WR2ABM	WOODBRIDGE	PL	146.22-146.82
NJ	WR2ABN	OAKLAND		146.10-146.70
NJ	WR2ABR	TOMS RIVER		146.31-146.91
NM	WR5ABG	LAS CRUCES		146.16-146.76
NY	WR2AAA	MANHATTAN		147.73-146.73
NY	WR2AAB	YONKERS		146.31-146.91
NY	WR2AAC	MANHATTAN		147.84-147.24
NY	WR2ABB	FISHKILL		146.37-146.97
NY	WR2ABE	PORT CHESTER		146.34-146.94
NY	WR2ABL	ELMIRA		146.16-146.70
NY	WR2ABQ	L. I.		147.63-147.03
NY	WR2ABS	BINGHAMTON		146.22-146.82
OH	WR8ABE	MIAMISBURG		146.22-146.82
OR	WR7ABE	PORTLAND		444.17-449.17
PA	WR3AAA	FREEDOM		146.25-146.85
PA	WR3ABD	RICHBORO		146.19-146.79
RI	WR1AAG	PROVIDENCE		146.10-146.70
SC	WR4ABM	LANCASTER		146.10-146.70
TN	WR4ACI	MANCHESTER		146.10-146.70
TX	WR5AAA	HOUSTON		146.26-146.86
TX	WR5ABB	SEGUIN		146.34-146.94
TX	WR5ABC	VICTORIA		146.16-146.76
UT	WR7AAA	CEDAR CITY		146.34-146.94
VA	WR4ABU	LYNCHBURG		146.01-146.61
WA	WR7ABC	RENTON		146.22-146.82
WI	WR9AAE	CEDARBURG	T 2250	146.37-146.97
WV	WR8ABB	FAIRMONT		146.28-146.86
JORDAN				
JY	JY73	AMMAN		146.34-146.94



MARA AUCTION

The Massasoit Amateur Radio Association of Hanson, Mass. will hold its annual auction. The date will be September 15, 1973 at 7:30 PM. The location will be The American Legion Hall, Hanson, Mass. Talk in on 6m, 50.40 MHz. Talk in on 2m, 146.94 MHz. For further information contact: Albert Jones, WA1OEY, Parsonage Street, Apartment 10, Marshfield, Mass. 02050. (617) 834-7637.

(Continued on p. 95)

JORDAN

A Report by Wayne Green W2NSD/1 on his recent trip to the Hashemite Kingdom

Back in 1966 I made a trip around the world, speaking to as many officials of smaller countries as I could, emphasizing the importance of amateur radio to the development of their countries. I spoke to the Secretary General of the ITU on this and, though everyone agreed with the concept, not much of a concrete nature came from my talks.

It is no accident, I feel, that the technical development of nations is parallel to the number of amateurs in those countries. Technical development depends on communications – as does all government and business – and communications in turn depends on having the people to plan, install, operate and service the communications systems. It is odd, but without some sort of technical hobby to attract teenagers, the pattern is that virtually everyone goes through school thinking in terms of working as a clerk, or perhaps as a doctor, lawyer or accountant. The idea of technical careers never seems to occur to them.

JY1Appears

Early in 1970 I began to get reports that His Majesty King Hussein was occasionally appearing on the air and getting clobbered by eager DXers who "needed" Jordan, even if it meant trampling a king to get it. I sent a cable to him offering to come over and work a few thousand frantic country hunters and hopefully take a bit of the pressure off. That was a magnanimous offer, wasn't it?

Much to my amazement I got a return cable saying yes. I quickly packed my toothbrush and got over to Amman as soon as I could – and found myself sitting at the royal ham station working a cacophony of DXers for several hours every day. I spent two weeks and had somewhat reduced the pressures by the time I had to get back to the magazine.

During this time I also took a few hours out to sit and talk with HM, as he is called. And, among other things, I brought up the Green manifesto of encouraging amateur radio in order to get teenagers interested in technical careers. HM seemed to like the idea and arranged a meeting of the top government officials involved and I explained it to them. Things looked good.

Wayne with the Arab headdress (shamagh) at the entrance to part of the Crusader castle at Karak. The sun is bright, but it's not hot due to the altitude.

A few days after I left Jordan there was another attempt on HM's life and then came the hijacking of the planes to Jordan and the resultant civil war between the Jordanian army and the Palestinian guerrillas. Though I didn't see how HM could do much to impliment my ideas while all this was going on, I did sit down and write up a proposed set of amateur regulations for Jordan – printed up a hundred copies and sent them on over with my fingers crossed.

JY1 Calls

One day, after making a slow scan contact with Athens, I got a call from JY1. HM was coming to the States and would like to meet me. This was last year. Lin and I met HM in Washington and were invited to come to Jordan to see what had been done to follow up on the development of amateur radio there.

My trip to Navassa and other commitments kept me from dashing right over and we finally got together on an appropriate time for my visit this spring. With the trip set for June I was a bit concerned about the weather – afraid that it would be miserably hot and detract from our seeing the country. I consulted an almanac and was frankly surprised to find that we could expect virtually perfect weather – and climate. The high temperature was listed as 84°, the low as 62° and the average as 73°. What better possible portent could I ask? The almanac also promised 30 days of sun for June so I didn't need any umbrella or raincoat. I took them anyway.

Before leaving I managed a couple of contacts with JY9BB in Amman and I got the distinct impression that there would be no serious objections to my bringing along a two meter repeater and some HT's. I decided to take along a Standard repeater and began looking around for one. A&W Electronics had one on hand that had been used for a while with the WA1MHN group in Boston on 07-67. They retuned it to 34-94 for me and we picked it up for me to take to Jordan.

Standard, sensing the importance of having this repeater work right, got into gear and called up to ask that we not take the A&W unit, since they had not had an opportunity to tune it at the factory to 34-94, and to let them send one by air that was factory adjusted for the job.

As the time to depart neared I suddenly realized that I should take along some sort of personal gift for HM. What do you give the king who has everything? I think Lin finally came up with the idea of getting him a menu board and white letters for it to use with his slow scan station at the palace. I checked with JY9BB to make sure that HM didn't have one of these – and got the okay.

My fingers walked through the Yellow Pages until I found a company that makes menu boards and letters and I phoned in the order.

After many phone calls and urgings, everything came together and I was off to London on my way to Amman – with a suitcase full of repeater and transceivers in tow. I also had a big bunch of HEP IC's, courtesy of Motorola, to give to the amateurs of Jordan to help them with their building projects. I also threw in some bags of parts gleaned from the Peterborough Honeywell plant – end of the line parts when they finished some circuit board projects. I was more than a little concerned about

what British customs would say when they got a look at the mass of radio gear and parts.

My flight to London was without incident — Pan Am 747 — disappointing food. For some reason the American lines don't seem to be able to make it on food quality like most of the foreign airlines.

When I arrived in London I tried hard to get my radio suitcase transferred to Alia, the Royal Jordanian Airline, so I wouldn't have to take it through customs. No good — it seems you can't transfer luggage for flights leaving over six hours later — and mine was two days later. Sigh. So I headed for the baggage and customs end of the airport and the prospect of massive official complications.

Surprisingly enough my luggage was already going around on an endless track when I got to the customs area. I loaded it on a shopping cart and went through a door marked "nothing to declare." The next thing I knew I was out among the buses and throngs and my customs worries had turned out to be needless — like most worries.

While wheeling my cart around the airport trying to follow the damned arrows to the taxi stands I happened by chance to swing by the Pan Am bus and was sucked up into it and eventually deposited in downtown London a few blocks from my hotel destination. That saved me a bundle.

In most cities I immediately get in touch with the amateur radio society, but after an incredibly painful experience with Sylvia Margolis ten years ago — which person, though not a ham, became the official greeter for the RSGB — I have avoided contact with RS and have in general done everything in my power to avoid ever having to even visit London, much less take a group there. Pity, too, because I do have a lot of very good friends in London and I really should overcome this peevishness and look my friends up when I visit.

Lin and I did get around to see a couple of shows — Private Lives by Noel Coward and Habeas Corpus with Alec Guinness. Then it was off to Amman and the real trip. Lin likes London and tries to get over there whenever she can. She likes it probably as much as I dislike it.

We checked in early for the Alia flight to Amman. It goes twice a week and we were on the Sunday flight. There was a short delay before leaving while some VIP's arrived and filled up what was left of the first class compartment. Lin and I, as guests of HM, were travelling first class. We were a little worried since the captain of the plane had at first apologized that he had no room for us in first class since he was holding the space for guests of HM. I said we were guests of HM and that seemed to take care of it. But still I suspected there might be other more important guests. There were.

The other seats were taken by Princess Muna (HM's ex-wife), her mother and father, and her children, plus a couple of aides. We made an unscheduled stop at Geneva to pick up the Queen Mother — and then we were off again to Jordan. I'd like to tell you about all of the ham talk with PM (JY2), but the fact is that she either didn't remember me from three years ago or was too wrapped up in her own problems and we didn't get even to the nodding stage of meeting.

King Meets Plane

On my last visit to Jordan I arrived via Alia from Beirut and, as we taxied up to the terminal, the Jordanian beside me leaned over and said, "Look, there is our king, come to meet the plane." While this was a lot more than I ever expected, I was able to take it in my stride — and, fortunately, keep quiet — for when I sort of chucklingly asked who the king had come to meet, the answer was, "His sister is on this flight." I was met by an aide, given the VIP treatment, and put up in the Intercontinental Hotel as a guest of HM.

This time HM met my plane again — greeting his family. Once that was over Lin and I got off and met our official greeters — JY9BB, Blackie (W4TA) and his wife Martha, Hisham Ansari JY5HA, the head of the Royal Jordanian Radio Amateur Society, and other dignitaries. Hisham, who was to be in charge of us for the duration of our visit, was instantly likable and full of good humor.

It would be unfair not to mention the fantastic feeding job Alia did on the trip down from London — what a difference from the food on Pan Am! It started with a choice of salads and then cold hors d'oeuvres such as roast beef, turkey, potato salad, paté, apple salad, nut salad, orange and pineapple salad. It would have been easy to make a meal of these alone — you could take as much as you liked.

The main course came next as they wheeled another wagon load of food out — with the choice of duck a l'orange, veal marsala, lamb chops, veal chops, lobster gratiné, chicken, and a wide variety of vegetables, rice, etc. I chose the duck and was not displeased.

For dessert they sent around another wagon — take as much as you like — peach melba, chocolate layer cake, fresh strawberries with whipped cream, a delicate chocolate pudding with whipped cream blended in, cheese and fruit.

Since the Queen Mother and Princess Muna, as well as HM's children were on this trip, I suspected that they might have gone all out on the food. A later flight to Egypt without the VIPs sported just as varied a menu and just as well done, so apparently that is standard fare for Alia. It is food for a king.

The time in Amman is six hours later than Eastern Daylight Time, so Lin and I went to bed as early as we could to work on the time change. Eleven at night there is only 5 PM back home so the result was that I spent virtually the entire night tossing and turning, eyes wide as saucers. Along about 6 AM (midnight at home) my eyes finally closed in sleep. About 7 AM it was time to get up and get ready for a very busy day. The two meter rig came alive as JY9BB

Wayne JY8AA and JY1.

The cabanas and swimming pools, part of the Jordan International Hotel.

called in on 94 direct to let me know that the tubes I'd brought him for his Gladding were both bad – and the repeater receiver didn't work. It was going to be a good day.

Lin and I yawned through breakfast in the Intercontinental Hotel coffeeshop – eating western style eggs – I must remember not to order sausage again – I'd forgotten about that – it is Vienna sausage and not exactly what I had in mind to go with breakfast eggs. As we finished up breakfast we found Hisham waiting for us with Blackie JY9BB and his wife Martha for a visit to Hussein Youth City and a mapping out of the details of our visit.

Blackie JY9BB and Prince Raad JY3HC.

At the Youth City we visited with Ibrahim Ayoub JY4IA, the top signal officer and an active ham – and we met Prince Raad JY5HC and tried out the station which he has in his office. We heard Raad on the air several times during the visit to Jordan and worked him a couple of times – so watch for him, he's very active.

From the Youth City we drove on up to the Jordan University and visited the club station there and met a few of the amateurs who were not involved in their final exams at the moment.

The station at the University JY6UJ consisted of a Collins KWM and the log showed not only a lot of activity from the station, but considerable good DX. Those fellows keep that rig going. There are 26 amateurs in the club, including 3 YL's! The shack is set up in its own separate building, which is excellent for the purpose and permits the members of the club a lot of freedom.

From the University we drove north of Amman a few miles to the ruins of Jarash. 30 miles. These were discovered in the 20's after having been covered by dust and sand for some 600 years. Jarash was one of the early Greek-Roman provincial cities and was in its peak in the first and second centuries AD.

We walked among the ancient columns, walking the same streets once busy with iron wheeled chariots – where there are two sets of Roman baths – a great oval forum – three theaters – thirteen churches – fountains – triumphal arches – even the remains of the street drainage system is still visible, complete with first century manhole covers.

Lunch was served in the Jarash resthouse. We had a dish called musakham – a broiled chicken dish that was finger-likkin' good, to coin a phrase. They take a young fryer, flatten it out and broil it on a thin loaf of Bedouin bread – with pine nuts and some sort of chili-type powder sprinkled all over it. Yum. The chicken fat seeps into the bread and the whole thing keeps you eating far beyond normal limits.

Lunch, we found, normally came on about 2 PM, and it was so huge that our appetite didn't return until along about midnight, if at all. Lunch usually included a nice tomato salad and the usual Arab dips – humus ba tahini, a delicious mixture of mashed sesame seeds and chick peas with olive oil and lemon juice – babaghanoush, a mixture of fried egg plant, olive oil and lemon – and some other varying dips, all good.

Not having slept much the night before I was pooped and glad to get back to the hotel after that big meal and get some sleep. On the way back we dropped Martha off at home and I made arrangements to come over later that evening to try and work home from JY9BB.

Since I'd missed getting a JY call on my previous visit, this seemed like a

The University of Jordan amateur radio club has 23 OM's and 3 YL's – here are JY5-UAA, UMS, UHH, UMM, UMR, UMN and UNM, standing outside the door of JY6UJ.

JY5UNM operating the KWM rig at JY6UJ club station.

good time to ask – and I found that, as I had recommended, tourists can get a two week license with the JY8 prefix. What would I like? Perhaps JY8WG? JY8NSD? I opted for JY8AA.

Back at the hotel a little later I was met by Karl Schulty WA2KBZ from New Jersey who was a Motorola technician operating out of Turkey. He was in town for a few days doing some work on Motorola gear for the Amman police. Karl wanted to get a visitor's license for JY since he would be there off and on for a year or so. I agreed to give his application to Hisham in the morning to speed it up. Karl for some odd reason didn't have

Hisham Ansari JY5HA, Secretary of the Royal Jordanian Radio Amateur Society.

an HT with him so I lent him one of mine. We talked back and forth with Blackie JY9BB, at his home, when he was mobile, and even when he was downtown visiting the palace.

If you're not into eating – particularly new and unusual foods, perhaps all my discussions of the foods of Jordan will bore you. To me visiting a new country is not only seeing all there is to see – meeting people and talking with them – but also finding out about the foods of the country. Oh, I've read the horror stories of goats eyes and things, but so far I've run into nothing but good and interesting foods. The big step is just to be willing to try anything.

On my last visit to Jordan I had dinner several times in a restaurant around the corner from the hotel. It wasn't a great restaurant, just a run of the mill Jordanian restaurant – but I was excited about it because it was


JY5KST


JY5KAA


JY5KMB


JY5KAL


JY5KSL

YL's at the girls' school in Karak.

Jordanian, while the hotel leaned toward European food – leaned heavily. I wanted Lin to see the Jordanian "salad" in particular so, after doing all we could to rebuild some fragments of an appetite, we headed for the restaurant, HT in hand, talking on 2m with Blackie and Karl.

The salad filled the table – perhaps a dozen dishes, or more. There were four or five dips, nice fresh pita (bread), and cucumbers, peppers, radishes, onions, tomatoes, etc. It was a meal in itself. We also ordered the roast chicken and chadwerma, little strips of roast lamb inside a slice of pita.

About half way through the salad it was obvious that we could never manage all that food so I picked up the HT and called Karl – who arrived about five minutes later, talked in over the HT, much to the amazement of the other diners.

My sched time to talk home neared so I left Lin and Karl to do what they could with the food and talked Blackie in to me for a lift to his house. By 2000 GMT the band was reasonably good and JY8AA managed to work W2NSD/1 with good signals both ways. The only news was that the FCC had finally released the 220 MHz CB docket. Big deal.

Though he had spent a good deal of the night typing up our itinerary, Hisham was at the hotel right on schedule at 8 AM for the second day's jaunt. Lin and I had caught up on our sleep a bit by this time and were better ready to face the antiquities. Martha joined us again this morning – she'd been in Jordan for several months, but had never had a chance to get to see the archeological sites for which the country is so famous, so she joined us on many of our trips and made up for lost time.

Four of the JY5's at Karak, decked out in local traditional costumes. Families often spend years making these intricately embroidered dresses.

I brought Karl's license application and handed it to Hisham. He checked it over, asked what call Karl wanted – I suggested JY9KS – okay – so I picked up my HT and called JY9KS from JY8AA. There was a whoop on the other end.

Our goal this morning was Karak, about 73 miles south of Amman. There we first visited the girl's school where I took some pictures of the YL's present. Four of them went off and returned a few minutes later in their family heirloom costumes.

Hisham has been driving down to Karak once a week to give classes in amateur radio for the girl's and the boy's clubs there. When you consider that about 80% of the youngsters stick with the classes – 100 sessions of code and theory – to get their tickets, you have to admire their tenacity. I don't think many classes in the U.S. graduate that high a percentage of students.

From the girl's school we went to the boy's and found 19 licensed amateurs anxiously waiting to say hello and show us their station – and the log full of DX. Several of them are well on their way toward getting confirmations from one hundred countries.

On the way to Karak we stopped at a resthouse for a Pepsi where Lin and I bought schamaghs – the Bedouin head coverings. These were worth a lot to us when we went to see the ruins of the crusader castle on top of the mountain at Karak. It was a bright and warm day, but the wind was so high that it kept us from gettting uncomfortable – other than possibly worrying about being blown off the top of the mountain.

The main fortifications at Karak were built in 1136 and, like me, are in remarkably good shape, considering their age. The castle commands the surrounding territory for many miles, towering at 3400 feet over the valley below – with the Dead Sea off in the distance. What a place for a repeater or a relay station! I'll bet that they put a relay in there to connect Aqaba, some 130 miles further south, with Amman. It would be an ideal spot – and there are two active ham clubs there to keep things perking – and even join in the fun.

The huge subterranean vaulted rooms are in good shape and not easily forgotten.

The resthouse at Karak was clean, like the rest, and everyone was most courteous and helpful. It is a pleasure to visit ruins without being badgered by people trying to fleece you with fake antiquities, postcards, and other dodges to pry your dollars away from you. Instead of this hounding that you get in most countries, here we were helped at all times by the Tourist Police (their name for government guides) who are there to help you, not for tips. They take a keen interest in you and a pride in your enjoying your visit to their spot.

For lunch we had kebobs with fried potatoes – and the ever popular humis ba tahini and Arab bread. Kebobs are ground lamb, molded together like sausage shaped hamburgers and roasted on a spit, like a shishkabob. Good.

Back in Amman, late that afternoon, we stopped off for some pastry and coffee. Arab pastry, such as baklava, is fantastic. It is made with paper thin layers of pastry, layers of nuts or fruits, and drenched in honey. Those readers who have the Time-Life cookbooks can see a photo of the assortment available in Amman on page 16 of the Mideast Cookbook.

Some of the licensed amateurs at the Karak Youth Center. Back row: JY5's KYA – KIN – KMM – KRM. Left to right, in front: JY5's KAQ – KAM – KKA – KHC – KMK – KKH – KAG – KMD – KXM – KNG. Many are well on the way to DXCC, though the club station is using just a dipole at present.

Back at the hotel I got in touch with JY9BB via 2m. Blackie had isolated the trouble with the repeater receiver – a joint came loose on the trip over – resoldered it, and the repeater seemed to be working, though not very well. We ascribed that to the makeshift antennas he had on it.

The hotel has a really first class restaurant up on the roof – one where the jet set dine and all that – so I invited Blackie and Martha over to have dinner with us there. But when we called for reservations we discovered that the restaurant was closed – a private party – so we went to the coffee shop restaurant and had nice, if strictly American, steak dinners with french fries.

Blackie wondered if I might want to go back to his place and work 20m for a couple hours. No. It was about 11 PM and definitely time to go to bed. I knew that Hisham, with car and driver, would be there waiting for us bright and early the next morning and that his schedule was a matter of honor. Hisham took pride in our sticking to that schedule.

Lin decided to sit out the next day's trip and try to catch up with her guitar practice. She has been going strong on learning classical guitar and it doesn't take much of a lapse in practice to slow down the process. The schedule we had been following left her with no time at all for practice. The Wednesday schedule included visits to two ham club stations, the Royal Signal School, and lunch at the Signal Officers mess. Lin is more into ruins and museums than ham clubs so this was a good day for her to miss.

Amman, with Jebel El Luweibida on the left. A photogenic city.

Blackie and Martha were interested in seeing the Signal School, so they were there at departure time as I struggled down with my bag full of cameras to greet Hisham – who was bright and cheery, as usual.

Our goal this morning was Zarka, a town a few miles to the east of Amman and our fist stop there was the Al Hussein Secondary Girls School where we were met by another bevy of very attractive girls. In all my years in amateur radio I've never seen so many beautiful YL amateurs together in one place. If the word gets around on this it could lead to a lot of visiting OMs. I'll leak the word.

Hisham has licensed 26 girls at the Al Hussein school so far and has quite a few more getting ready for their exam. The club station there uses an FTDx101 with a dipole – call JY6HS. The girls are really into QSL collecting and many have struck up friendships over the air. They all are enthusiastic about learning English better via amateur radio and the fondest wish of most of them is to someday have their own station.

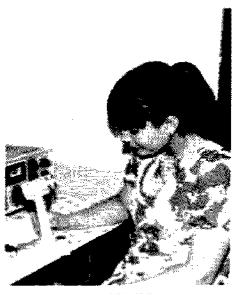
Frankly, after talking with the girls and boys who are hamming over here, and finding out how impossible it is for them to get equipment, I am hoping that the readers of 73 will take a long serious look at their unused equipment and make it available for kids like these. Old receivers, old sideband or CW exciters, old rigs – all would be a Godsend to these enthusiastic people. I talked with King Hussein about this and arrangements have been made to take care of getting equipment from the U. S. to Jordan, tax free, shipping free – for ham clubs and amateurs in Jordan.

The next stop was the Royal Signal School where the army technicians are taught radio and electronics. This harkened me back to my days at the naval radio materiel school on

JY5HHB

JY5HFM

JY5HRM



JY5HMK

JY5HHH

JY5HDY

JY5HNI

JY5HJM

JY5HAD

JY5HBS

YL's at the Al Hussein school in Zarka. Almost half the girls who run the club station JY6HS are shown above.

Treasure Island in 1943 – hmmm, thirty years ago. They teach the basics of electronics as well as the working and servicing of all of the radio and signal equipment used by the army. This runs the gamut from sophisticated synthesized gear all the way back to things like that Russian Mark II tank transceiver that was selling surplus for $30 in 1946 – Gimbels ran a special on them, believe it or not. They were so useless that hams were never much interested, preferring tnem as boat anchors to rigs. Jordan is still using these gems.

Perhaps a word of explanation would clarify things at this time. Jordan is in a particularly difficult position – the country has virtually no natural resources. There is no oil, darned little water, no sources of generating power, and about 90% of the food has to be imported. The only thing exportable is phosphate and they shipped out about one million tons of that last year. The main income is from tourism – which may explain why Jordan has paid such detailed attention to making tourism perfect in every way they can think of.

It is surprising to see so much construction and long range plans under way in a country so recently devastated by civil war. The political situation appears to be stabilized for some time to come now and this has made it possible for the entire country to set its sights on building for the future.

There is no way to do justice to the complexities of the Israel-Jordan-Palestinian political problems in much less than a book – and the emotions involved make it rather non-productive to try to be even handed. I've had people give me hell for even showing slides of Jordan – and we've lost more than one advertiser – that's a fact. The pressures in Jordan have eased to the point of being unnoticeable since the Palestinian guerillas have been moved out of the country and up to Syria and Lebanon. It looks to me as if the tensions have eased substantially in the area.

Tensions in Syria and Egypt are kept high for internal political reasons in those countries, and while there is always the possibility that these countries may be able to precipitate trouble, it would appear that they will no longer be able to involve Jordan – at least for the forseeable future.

They have a particularly active ham club station in the signals school and the chief op, Shukri, using the call JY6RS, has well over 150 countries worked. Other particularly active ops at this club station are JY5's RAS, REM, RBM, RGM and RGT.

Shukri has over 150 countries operatıng the club station JY6RS at the Royal Signal School in Zarka, just east of Amman. Other ops at this station include JY5's REM, RAS, RGM, RGT and RBM.

Operation at the club station was interrupted by word that lunch was ready. The main course was one of the best known Jordanian specialties, Mansaf. You may have read about it. This is not only incredibly delicious, but it is real fun to eat. It is served on a very large platter on a table and everyone stands around the table, eating with their right hand. Lefties have a problem. There is a huge mount of rice on top of very large slices of Bedouin bread – and then all around the rice are pieces of boiled lamb. A yoghert meat sauce is poured over the whole works – and each person is served a hot glass of this sauce.

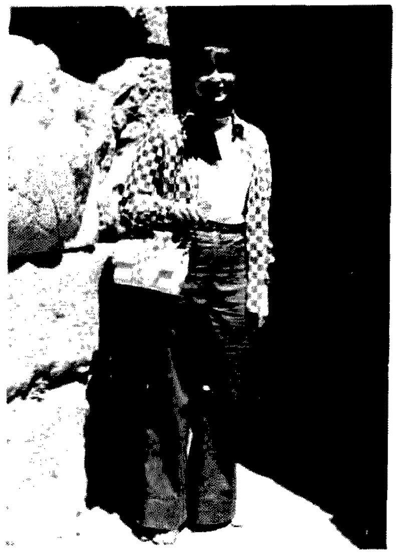
The idea is to break off some lamb from a bone and then work a gob of rice around the lamb, all with one hand. When you get it into a ball you sort of flip it into your mouth, like a large marble. This calls for considerable dexterity and very careful aim when you flick. It is difficult to keep that left hand out of the action, although it is acceptable to use it for the glass of sauce. The sauce, by the way, tasted very much like one that I make to go with chicken – a sour cream and white wine mixture, with some onions.

I found my hand getting gooier and gooier, with rice sticking all over it. It

You eat mansaı wıtn your right hand, standing up. Boiled lamb with a huge pile of rice and the most delicious sauce you ever tasted. It takes practice to eat with one hand.

was difficult to make rice balls with that soggy stuff which tended more to ooze between the fingers than gather into the required lumps. The lack of practice didn't spoil the fun or the taste one bit – and I'm looking forward to getting expert at mansaffing.

Why the right hand for eating? Well, ahem, just a bit of Arab protocol hanging fire from the old desert days before the invention of toilet paper when the right hand was used for greeting and eating, and the left hand for – err – other things. Perhaps you can imagine what a serious problem thieves had once their right hand had been hacked off – they could no longer eat in company.



Lin, XYL of Wayne JY8AA.

Lin was sorry to miss the mansaf feast, but not all that disappointed to miss the ham clubs, the signal school, and that sort of thing. She managed about six hours of guitar practice, so she was a lot happier.

We had a long trip ahead of us the next morning so we rendezvoused early and got away from the hotel by 7 AM. Our goal was Aqaba, a small town on the gulf of Aqaba, a branch of the Red Sea, 210 miles to the south. On the way we would visit the ancient city of Petra, 170 miles south.

Over a period of five hundred years the Nabataean Arabs lived in Petra and carved it out of the stone mountains. This was a strong city about 300 BC, being on the caravan route from Mecca and other places to the south of the way to the Mediterranean. Rome conquered it in 106 AD and added the usual theater – also carved out of the rock – and a columned street, temples and such.

The crusaders built a fort there in the 12th century, but changing trade routes cut the income from this

source and the city gradually was deserted. Petra was lost to the world until accidentally discovered by a Swiss explorer in 1812.

We arrived at Petra about 11 AM and, after a cold drink of Pepsi at the beautiful resthouse – much of it cut out of the limestone mountain – we put on our Arab headdresses and mounted our Arabian horses for the ride through the city. Lin led the way – I followed next, balancing my camera case on the saddle and snapping pictures with this lens and then that as we rode through the siq – the very long winding defile between rock cliffs that tower 300 feet or more on both sides for perhaps a mile or more. Hisham, ever game for anything, kept up the rear on his horse.

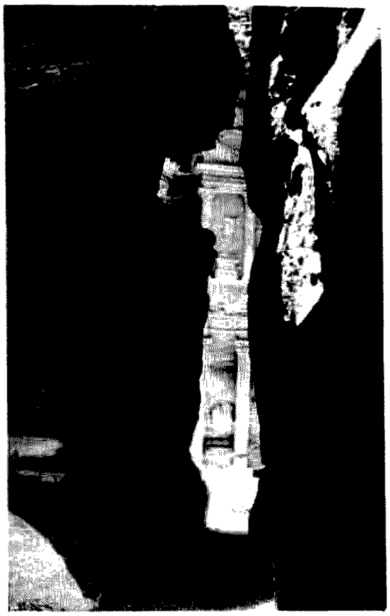
It was fascinating to see how that Petrans had carved troughs for water on both sides of the defile, permitting water to run its length. The ride through the devile was cool – the temperature was perhaps in the low 80's – but once in the sun I appreciated the shamagh on my head, even though I had to struggle a bit with it now and then when my camera straps would wrench it awry.

The first glimpse of the city is through the defile when the treasurey suddenly comes into view – shining pale red in the sun – a fantastic building carved right out of the stone mountain. That set my cameras to snapping so fast I could hardly keep up with them – black and white for the magazine – color for maybe a cover and for hamfests – and bragging. Wide angle, telephoto – I was whipping cameras around, jumping here and there – hold still.

Since seeing that city I decided that no description is really possible and the only honest alternative is to get every possible reader I can to go there and see it personally. The cliffs of the city are busy with patiently carved homes – complete with stairs cut into the face of the cliff and even water aquaducts leading to a great many of them. How about homes with running water in them 2000 years ago! And, being carved out of the mountains, they are cool even in the hottest weather.

An archeological expedition was hard at work in the area, digging away. More pictures. And they have an interesting museum in some of the caves up on the side of a mountain which you get to by going up the ancient carved stairs. The theater, a newer addition, about 200 AD, seats some 3000. It goes on and on.

There is a resthouse right in the center of the old city of Petra where they can put up about 70 people for the night, if desired. Some of the



First view of the city of Petra as you come on horseback through the long defile.

rooms are in the ancient caves, so that might be an experience – particularly for someone sensitive to the occult.

But we were on our way to Aqaba, so we finished our drinks, pictures and took one last remembering look as we swung back on our horses for the trip back up through the long defile.

Late in the afternoon we arrived at Aqaba. A lot could be said about the beauty of driving through the desert on the way – in some areas vast sections were planted – wheat, I think – though how anything could grow here is a mystery to me. There is no rain at all in June or July – and perhaps a couple of days in August at best. The rain comes in the winter – and perhaps there is enough to stick and keep working through the summer.

We passed the area where Lawrence of Arabia was filmed – and succeeding vistas of incredible beauty. We paused at a reathouse on a mountaintop for cold drinks – pictures – and whatever. What a fantastic spot for a repeater.

The gulf of Aqaba is a gorgeous blue color, with the small city of Aqaba on the left and the Israel city of Eilat on the right, only a few meters away. This is Jordan's only seaport – and it is certainly out of the way, with the Suez Canal closed. Syria and Iraq have their borders closed, which means that goods shipped in to Jordan must either come by air or around Africa and up the Red Sea – one hell of a long trip.

While I realize the frustrations and resentment of the Palestinians against Israel, this situation, which helps to prevent some sort of agreement on a corridor through Israel to the Mediterranian, is excessively costly to Jordan. The high costs of importing things slows down the growth of the country by forcing people to pay too high a price for things – and slows down growth also by making it extremely difficult to export anything.

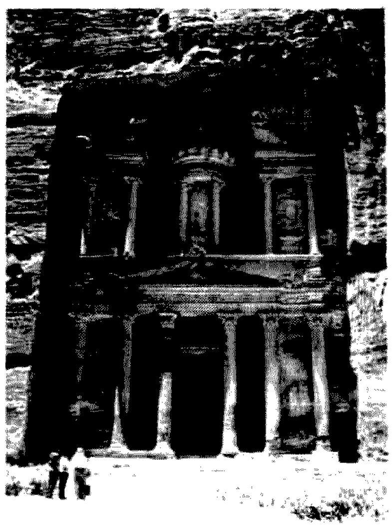
We checked into one of the two first class resort hotels and had a late lunch. Karl, who had driven down the day before to work on some police equipment, called in on 94 and came over for a visit. Two meters sure does help to make travel enjoyable.

Later Lin and I put on our suits and went for a swim in the Red Sea. As we were swimming King Hussein circled overhead in his small plane – he was down for the weekend to visit with his family.

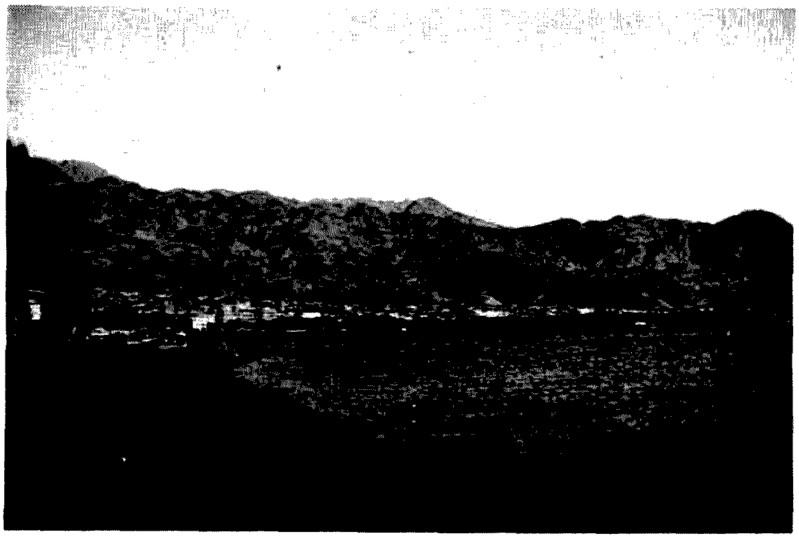
Even though the water of the gulf keeps things cooler than they would be otherwise, we appreciated the air conditioning of the hotel for sleeping.

The next morning, after one more dip in the Red Sea – and a good breakfast with bacon and eggs – plus a Jordanian breakfast for Hisham which, while good, didn't seem as satisfying as the old favorite. I like the goat cheese and the humus spread – Lin digs the olives – but after years of orange juice and eggs – etc.

I dozed off during much of the long drive back up through the desert, not coming full awake until we reached Madaba, just 20 miles from Amman. Here we stopped for some cold drinks and then went off to see as many of the mosaics for which the area Is famous as possible. We drove up to Mt. Nebo, not far away, and visited the spot where Moses viewed the promised land. We could see across the end of the Dead Sea into Palestine



The Treasury at Petra, carved out of the rose-colored rock of the mountain. Inside are a large room and two smaller rooms. Carved out around 300 BC.



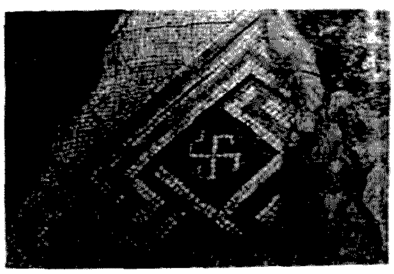
The beach at Aqaba is lovely – and look at those mountains – what a spot for a repeater! There are first class resort hotels here on the Riviera of Jordan. This is Jordan's only seaport. The Gulf of Aqaba is part of the Red Sea and they have skin diving, water skiing and great swimming.

and Jerusalem. Quite a bit of work has been done on this site to preserve and repair extensive mosaics laid down at different times, from about 300 BC until the Byzantine times. This work is painstaking and fascinating to see.

The most famous mosaic of all is in this town – a mosaic map of Palestine in the 6th century. The map shows Eqypt and Palestine with a detailed representation of Jerusalem as it was in the days of Justinian. This is the *only* map existant of the period. White blocks on black lines depict roads. Ancient monestaries in the desert are shown.

We saw some recently discovered mosaics – some which had not even been uncovered as yet – and we learned that there are many more awaiting discovery as the locations of old churches are found.

A Bedouin tent outside of the Madaba resthouse was our lunch stop. We lounged on cushions on the Persian rugs which covered the ground as we waited for lunch to be served. There was the ritual round of Bedouin coffee and then we were into a delicious musakhan – chicken broiled on Bedouin bread with spices and pine nuts over it. There just has to be some way to get you over here to see this and taste it! It isn't fair for me to enjoy something this much without sharing it with everyone.



In Madaba you can see a great many ancient mosaics such as this one which has just been recently discovered and has not yet been cleaned of the dirt covering it. The swastica is a very old good luck sign.

That night I got on the air again as JY8AA and found that although most ops had worked JY by now, I was the first JY8 they'd heard and the prefix hunters were vigorously at it – interspersed with Italian stations, who appear to attack anything that moves. It is fun being rare DX like that – a lot of fun. I worked stations all over Europe – with the pileups toppling over on me now and then. Then the U. S. came in and a contact with the home station where I found that things were going as usual – an office party had replaced work for the day at 73.

On our sixth day in Jordan we first drove to the television studios and explored them. Having worked in television in both engineering and direction, this was familiar territory for me. They are just converting to color and are greatly expanding their operation. I talked a bit with the director of the station and was impressed with his grasp of the economic and political situation – I guess I keep expecting to run into emotionally biased people and am constantly surprised to find level heads. Delusions are bad enough with average citizens, but are a serious liability in top level jobs.

The next stop was the broadcasting studios – radio is still an important force in the Mideast, what with Egypt pouring out propaganda and venom against Israel, Jordan, and any other country that frustrates the political aspirations of Sadat. Ditto Syria and Iraq. Much against its will, Jordan finds that it has to try and keep up with the propaganda barrage by setting up ever more powerful transmitters.

The Jordanian ploy is to provide honest and unbiased news – to try and provide a calming influence between the shrill cries of their neighbors and the extremists. It is unfortunate that no one gets much in the way of followers in this way – the followers seem to go off after the more emotional "leaders."

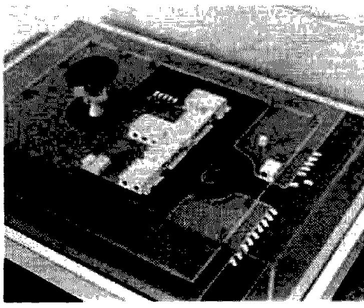
The director of the radio system explained that he regretted very much that there seemed to be no alternative to setting up two 1.2 megawatt broadcast transmitters – a $12 million investment. Plus about $1.5 million a year in operating cost for them. Jordan has a great need for this money for other developments – but without some counter to the propaganda, there might not be a Jordan. I'll tell you this, I'm sure that if anyone anywhere can come up with some other good solution to this problem, they will find willing ears. Keep in mind that inexpensive transistor radios have made radio a very important communications medium in low income countries.

JY5MAM, one of the principle operators at the Madaba club station in the Youth Center, JY6MC.

Our next stop was the earth satellite ground station, a few miles north of Amman. They pick up the signals there and relay them via passive reflectors into town. Passive reflectors, if you're not sure, are those big billboard size things you see here and there on mountain tops.

This satellite station is how I was able to rather quickly make a phone call to Amman from New Hampshire – and have a call that was clear and loud. Not very many countries are hooked into the satellite system as yet, so the result is that you can call the U. S. from Jordan a lot easier than you can call into the next country.

The big dish is run by a computer and was put in by Nippon Electric. The emergency power supply consists of a couple of big diesel generators – with batteries to take the load during the few seconds it takes to get the



Model of the earth satellite station which permits Jordan to have excellent phone and television service via the 100 foot dish. The station is a few miles north of Amman.

generators going. From the big dish we Drove back to Amman and the Al Hussein Youth City – a complex of parks – playing fields – auditorium – swimming pools – and an athletic field with a huge grandstand. Here we toured the immense place and ended up with a luncheon served in the restaurant. Most of the active JY4 and JY9 amateurs were there for this occasion of state, with Prince Raad JY5HC being the host.

Food again. We started with the Bedouin coffee maneuver and then were presented with jumbo shrimps on a skewer – about eight of them. This, with the normal Jordanian salad and dips in the middle of the table, was enough to fill anyone. The shrimps were huge and delicious. Just as Lin and I managed to finish them off, in came the main course. The shrimp had merely been the usual English fish course – served before the main meal.

The main course was a veal steak with pate (something like liverwurst) – and the desert was something new for me – rose flavored ice cream. Yep, rose. Good too. Y'hear that Baskin Robbins? Why are you trying to waste our digestions on bubblegum ice cream when you could get going on rose and who knows what other flower flavors?

I got in another evening of 20m operating while Lin worked on her guitar practice. I stuck it out this time until the wee hours, working into South America, Japan, and just about everywhere in the world. JY8 is not as rare as it was.

The next morning we had set aside for getting the two meter repeater going. Blackie had it working fairly well at his house – the job now was to get it set up somewhere high to serve the whole city. Hisham, Blackie and I, with an army driver, loaded the repeater into a car and headed off out of town. Hey, what happened to the idea of putting the repeater on the hill overlooking the city? Hisham explained that the mosque we wanted to use couldn't be entered today since this was Sunday and we would have to try it somewhere else.

The somewhere else was about ten miles out of town to the north. It was a nice location on top of a hill with a beautiful tower – 200 foot or more high. With misgivings I watched while a couple of army men zipped up the tower and set up the receiving antenna. I have to admit that I have never set up a repeater with greater ease. We then set up the transmitting antenna about 100 feet lower than the receiving antenna and I turned on the repeater. No troubles apparent.

We kerchunked our hand units a couple times and then Blackie drove off in his car in one direction while Hisham and I took off in the opposite direction, around a formidable mountain. The repeater disappeared almost as soon as we went around the mountain. Hmm – I expected some problems, but nothing as bad as that! We turned around and drove back, picking up the repeater again when within a couple miles of it. We would never be able to use that from Amman which was ten miles away.

Grumbling, I had them take down the antennas and pack up the repeater so we could take it to Amman and put it up on the biggest hill overlooking the city. There was a passive reflector site not far from the top of this mountain, so we headed there. No towers at this site, just a couple of those billboards, so getting antenna separation for the repeater was going to be a challenge.

At first we put the repeater on the ground under one of the reflectors and snapped one gutter-clip antenna to the top of the reflector and another to the bottom. Even with only about 20 feet of spacing I couldn't detect any desensitization – that was odd. We kerchunked again and drove off in opposite directions again. Within blocks I found I had lost the repeater. Something is very wrong. Could the problem be desense? Or what? Blackie and I pondered the situation.

Hisham and I returned to the hotel, on the other side of town. Here I made a test with Blackie and found that while I was coming through 9-plus on 94 direct to his HT, I wasn't making it on 34 through the repeater receiver. Okay, now we know! Let's take a look at that receiver board and see if the antenna wire is broken off or shorted. Blackie opened it up and removed a little piece of solder – and we had a beautiful working repeater! A little chip across the antenna input was all it took – there still was enough zoop to work with nearby rigs, but weak signals couldn't make it.

I could work into the repeater even from inside the elevator of the hotel and it wasn't long before I'd had contacts with Karl – Major Zaza JY3BZ, the personal aide to HM, – Prince Raad and others. I'd brought along three hand units plus a TR-22 and they were all in use.

That afternoon word came that HM had me on his schedule for a visit. I'd been waiting for this, so I put on a tie and jacket, grabbed up my list of ideas and impressions, and we all headed for the palace. I almost forgot to bring along the menu board which I had gotten for HM – and some New Hampshire candy.

Major Zaza greeted us – Blackie – Hisham – Lin and me, and showed us into the reception room. Soon HM joined us, with Prince Hassan, his brother. I started talking.

Hisham, who has an eye for these things, timed it at one hour and fifty minutes. I covered a lot of items – some of possible interest – some already in the works – some probably not too practical.

I was impressed by the possibilities of a vast canyon, miles long, called Wadi Mujib. During the rainy season it is obvious that a lot of water runs down this wadi and off into the Dead Sea. It looked to me as if it would be possible to make a dam on the downward side of this wadi and thus collect the water that would normally run into the sea. This water could be pumped up to the top of the wadi and fed by gravity to irrigate the surrounding desert. I had suggested this to several people, only to be argued that it couldn't be done. HM assured me that they are working on it and that it will indeed be done. Not all my ideas are practical – even when they are as grandiose as that.

The road through Wadi Mujib was exciting – it wound down one side of the canyon walls, hairpin turning back and forth – then across a bridge on the bottom over the dry riverbed – and hairpins back up the other side – I'll bet that goes up 4000 feet on either side! Along the way we passed road markers put there by the Romans almost 2000 years ago – still at their job.

After I finished expounding on my ideas we all went up to the third floor to the hamshack – in a little alcove just off the roof. I set up the menu board and made a couple slow scan television contacts with VU2's, one as JY1 and the other as JY8AA, while HM looked on. Queen Alia, HM's new bride, came up and greeted us – she is lovely – beautiful! Lin had to remind me that it would be prudent if I were to take some pictures of HM at this time. I was so wrapped up in the slow scan contacts I almost forgot about everything else.

It was time to let HM get a crack at the slow scan so we all trooped back

downstairs and bid HM and Queen Alia goodbye.

That evening I again held forth on 20m – getting in as many slow scan contacts as I could via my tape recorder. Most of the SSTV group were too busy making local contacts to even listen for me, so I made far fewer than I hoped for. Time after time Italian stations would come on channel and fire up with endless slow scan pictures – sending for ten or fifteen minutes at a time until I had to move off channel and try to get away from them that way. Few of them could apparently understand one single word of English so my sobbing pleas to just send one or two pictures and let me work some more stations went completely unheeded.

With the exception of the slow scan frustrations, DXing was first rate and my log sheets filled up rapidly – the main problem being to get the calls of the multitudes calling. I had my best luck when I asked for stations with a one in their calls – then a two – etc., with the ever present difficulty of the large numbers of I's who apparently had no knowledge of English, and were not about to cooperate in anything I had in mind – "the QTH here is Civitavecchia, I spella for you twice, C – Canada. . . " etc.

Monday, my last day in Jordan, had us scheduled for a visit to the Royal Scientific Society – then a drive up to the very northern border of Jordan to visit the youth club in Irbid (and the ham club station there), with lunch at the Al Hemma hot springs on the Syrian-Israel border to Jordan. Blackie and Martha came with us to the Scientific Society where we were joined by Col. Ayoub JY4IA and shown around by Elie Baghdady, the president of the Society.

The scientific equipment in the labs was impressive and must be most helpful to students wanting to go into advanced studies. Even more impressive were the preproduction models for a high band walkie-talkie which they are working on with the

Brigadier General Ayoub JY4IA, Wayne JY8AA/W2NSD and Hisham Ansari JY5HA, secretary of the RJRAS.

idea of possible commercial development. The physical construction was the most sturdy that I've seen – and the unit is designed for ultra-simple servicing – a coin being the only tool needed for taking it apart and changing the plug-in modules.

They are also hard at work on an optical scanner that would read the writing on a page and convert it into digital information. This has many applications in communications – in computers – record keeping. With work like this going on, no wonder they are so enthusiastic about the amateur radio program throughout the top level of the government. They'll need every technically interested person they can get if they are going to start manufacturing transceivers and computer equipment. I don't think I'm exaggerating when I say that I think that plans like this would have been totally impossible just three years ago.

Our interest in the work at the Royal Scientific Society put us behind on Hisham's schedule for the first time in a week. We didn't have much time to oblige the television crew that was there doing a film of us for the news that night – though we later heard that it came out well and was most interesting. Martha, Lin, Hisham and I piled into one of HM's new Volvo's and our driver headed north – past the satellite tracking station – past Jarash – and 73 miles to Irbid.

The first stop was the ham club at the youth center there, JY5IC. There were only a few ops present, but we talked for a while and I snapped some pictures to show back home. From there we drove up to a point overlooking the borders of Syria and Israel – with a fine view of the Sea of Galilee. We went through a few of the ruins here – spotting some mosaics that would soon be uncovered on the site of an old christian church circa perhaps about 400 AD.

Much of Jordan is on a plain about 3000 feet above sea level – which accounts for its relatively cool climate – the altitude does make a profound difference. As soon as we wound our way down from the plain to the hot springs at Al Hemma, much closer to sea level, we found ourselves in a hot climate with tropical trees growing all around.

The hot springs are very helpful for many illnesses and we saw people being brought to the baths on stretchers for healing. This is a popular type of healing in Europe, too.

Our lunch was served by the large swimming pool – starting again with the strong, sour Bedouin coffee – the ritual where you have to give the cup a little wiggle as you return it if you are going to ward off a refill. Then came the big salad – and platter after platter of small beef steaks and chicken – a belt-busting feast. Fresh apricots, cucumbers and plums came for desert.

On the way back I dozed off a bit, getting rested for the farewell reception coming that evening at the Royal Automobile Club.

Many of the top men of the country were at the reception and I had a chance to talk with quite a few of them. The most important piece of news came from Ali Ghandour of Alia, the Royal Jordanian Airline – and that was about the coming flights from New York by Alia, starting in November. He explained that there would be a special group rate for a

JY5IBM

JY5IAT

JY5IMH and JY5IBR

Operators at the club station at Irbid, a city near the northern border of Jordan. The club station is located in the Youth Center of Irbid. Nearby there are many newly discovered ruins which are being uncovered.

one week visit in Jordan — only $340 round trip! The first class fare is about $1500 — the special tourist 14-day rate is about $800 — and that was the cheapest I'd found so far.

Remember that Jordan is almost twice as far as London from New York. It's almost 6000 miles.

In addition to the special fare, Alia has arranged for special rates at the Jordan Intercontinental Hotel — a truly first class hotel. This means that the total cost of a visit to Jordan for a week would run about $600. On that basis it would seem prudent to start thinking *in terms of organizing* a 73 tour of Jordan for, say, next spring. In addition to seeing some of the most remarkable antiquities, eating exciting new foods, and probably meeting one of the key men in the world today: King Hussein.

If this has piqued your imagination, you might consider that I understand that there will be a first rate DX ham station set up in the hotel — plus that 34-94 repeater in Amman — you'll bring a hand unit with you, won't you? — and, for frosting on the cake: a ham rig on the plane to be used during the flight over and back!!! That's a three exclamation pointer if there ever was one.

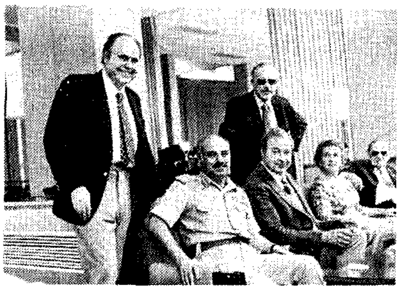
The next day Lin and I packed and got on the morning flight to Cairo via Alia Airlines. On the way to the airport HM called me via the repeater and thanked me for taking the time to come over and see the country and give them my ideas on development. I don't know how much value my ideas have for Jordan, but I do know that the visit was a priceless treasure for my memory.

Security measures are strict and I found guards on the plane making sure there was no funny business. That was nice.

The food was just as first class on this short trip to Cairo as on the one down from London. They sure pull out all stops on serving excellent food.

A short while later we got off the plane in Cairo where it was hot — very hot. The hassles started almost immediately. They demanded that everyone change $80 each in U. S. money into Egyptian currency before they would let us out of the entry room. And we had to list all of the money of any kind that we had along — this list to be compared to our declaration upon leaving to make sure that we don't indulge in buying Egyptian Pounds at the low black market rates.

Once free of that hassle — imagine them insisting on us spending $80 each for a two day stay — we started out towards the taxis and our first real brush with the constant attempts at



JY8AA, JY4IA, JY9BB, JY9GR and XYL, JY9FOV.

fleecing that became a part of this visit to Egypt. Having been there before I asked the first taxi driver who rushed up — followed by the pack — if he had a meter — oh yes indeed — okay we want to go to the Nile Hilton — our bags were grabbed up and put into a car trunk — where is the meter? — suddenly the taxi driver knew no English — how much for the trip I asked him — his English was barely discernable now as I decyphered two pounds from the long explanation he was giving. Hmmm — that's not bad — about $3.50 — and it is a long trip. Just to be sure I turned to another taxi and asked him how much it would cost to the Hilton — oh, less than one pound — okay, take the bags out and into this cab with a meter — the metered fare came to 73 piasters (by coincidence), so I gave the driver a pound (100 piasters).

There are an incredible number of very poor people in Egypt so they have worked out a system — like one man takes each of your bags when they are carried anywhere — this gets a little more in tips. Merely nearing the door of the hotel on your way out brings a swarm of "guides" who will take you anywhere and show you anything — for a very nice price. They are so persistant that eventually it keeps you from even wanting to leave your hotel room. You can't shake them — and if you do get away, within a block more have spotted you and zeroed in. They expect a no from you and seem to count on wearing you down by persistance.

Though I tried many dodges, the only one that seemed to have any possibilities of working was where I would turn on the nearest con artist and demand 10 piasters from him in exchange for taking his picture — which I promised I would show all over the U. S. — explaining that he might become a famous movie star — Omar Sharif — etc. That backed 'em off.

The Pyramids

By shrewd bargaining I was able to engage a guide with a car for the whole day to see the antiquities at only about five times what I should have paid. We drove to Memphis and saw the big statue they have there — lying down — with a small sphynx outside. We went to visit some of the tombs — riding across the desert on donkeys. We rode camels at the site of the sphynx and major pyramids — as well as some Arabian horses.

The desert sun was too much for Lin, who had forgotten to bring her Jordanian schamagh, so we returned to the hotel early. Food poisoning from the dinner in the Hilton that night capped the day for her and we had to call a doctor the next morning.

Once I'd met the doctor, who was very nice, I realized that I'd seen him in the hotel quite a bit, with his sheaf of room call slips in one hand. That restaurant must keep him busy.

Lin had to stay in bed that whole day — and eat very little. The next morning she was able to get out a bit, but was still weak — and her enthusiasm for the remainder of the trip had evaporated. We were scheduled to spend a couple days in Damascus where we would see Rasheed YK1AA, a couple of days in Rome, Paris, and then back to New Hampshire. The next flight back was TWA the following morning so we changed our tickets and sent cables to Rasheed and 73 about the change.

The Cairo airport the next morning was another Chinese fire drill — with hands out for tips at every turn — one man per bag from the hotel to the taxi — from the taxi to the customs lines — from there to the passport area — from there to the baggage check in. Did I say lines? Pileups is more accurate. No one in charge — little information available from anyone on what to do, where to go. And just to cap the situation, I was groggy and sick, having managed to get food poisoning at dinner at the Hilton the night before.

Everything that happened in Egypt made me appreciate Jordan the more. The people are different — the climate is different — and, most of all, the whole government attitude is completely different. Every minute in Egypt made me appreciate Jordan more.

We arrived home that night — tired — dizzy from the ravages of King Tut's Revenge — and the fast time change.

After the royal red carpet treatment in Jordan, it was difficult to get back and settle into being just a face in the crowd.

. . .W2NSD/JY8AA

AMATEURS IN JORDAN - JY
ASIA - ZONE 20

Cards may be sent via RJRAS QSL Manager, P.O. Box 2353, Amman, Jordan.

Call	Name	Town	P.O.B.
JY1	Al Hussein Ibn Talal	Amman	1055
JY1XYL	Alia Al Hussein	"	1055
JY1/B	Bader Zaza	"	1055
JY2	Muna Al Hussein	"	2101
JY3BZ	Bader Zaza	"	1352
JY4AH	Amin Husseini	"	
JY4IA	Ibrahim Ayoub	"	2353
JY5AA	Adel Assali	"	2353
JY5AH	Ayed Hijazi	"	
JYASA	Aymen Mazahreh	Zerka	
JY5ASB	Bassam Nimer	"	
JY5ASC	Muner Farra	"	
JY5ASD	Ahmed Mureih	"	
KY5ASE	Foad Ibrahim	"	
JY5AT	Arshaq Tafnian	Amman	
JY5FCA	Ahmed Abo Saif	"	
JY5FCB	Khalaf Saleh	"	
JY5FCC	Hillal Hillal	"	
JY5FCD	Ali Hamed	"	
JY5FCE	Mohamed Assaf	"	
JY5FCF	Mohamed Sarhan	"	
JY5FCG	Abed Mohamad	"	
JY5FCH	Habes Ahmad	"	
JY5FCI	Abdulla Mushrish	"	
JY5FCJ	Jamal Mansour	"	
JY5FCK	Abdel Hafiz Sulieman	"	
JY5FCL	Kayed Mohamed	"	
JY5FCM	Omar Abed	"	
JY5FCN	Nofan Khleif	"	
KY5FCO	Mahmoud Nofan	"	
JY5FCP	Murdi Khader	"	
KY5FCQ	Mohamed Nor Ali	"	
JY5FCR	Adel Mahmoud	"	
JY5FCS	Hussein Hussein	"	
JY5FH	Fathi Homoud	"	
JY5FM	Fayez Tawfeeq	"	
JY5FT	Abdel Fatah Tabbalat	"	
JY5GQ	Ghazi Qubien	"	
JY5HA	Hisham Ansari	"	
JY5HAA	Aida Afifi	Zarqa	
JY5HAD	Abeer Mahmoud	"	
JY5HBS	Suhair Abdul Kareem	"	
JY5HC	Raad Ben Zaid	Amman	
JY5HCS	Shadia Kheir	Zarqa	
JY5HCT	Shahnoz Altel	"	
JY5HDY	Rudaina Yacoub	"	
JY5HED	Eiman Mamdoh	"	
JY5HFM	Firyal Abou Salma	"	
JY5HFR	Fatima Rashid	"	
JY5HOM	Jawaher Mohod	"	
JY5HHB	Hana Basheir	"	
JY5HHC	Haifa Shibli	"	
JY5HHF	Hayat Abaza	"	
JY5HHH	Hala Hilal	"	
JY5HHM	Hikmat Muhsen	"	
JY5HHS	Huda Sabri	"	
JY5HIN	Ibtisam Hashem	"	
JY6HHA	Kafa Atalla	"	
JY5HMK	Marry Khasawneh	"	
JY5HMN	Marry Nima	"	
JY5HMQ	Misbah Qurashi	"	
JY5HMS	Majida Sayyad	"	
JY5HNB	Najat Badri	"	
JY5HNI	Nadia Ibrahim	"	
JY5HNM	Nariman Mohamed	"	
JY5HNR	Nabeela Roosan	"	
JY5HRM	Rateeba Mahmoud	"	
JY5HSA	Samar Fawaz	"	
JY5HSM	Siham Fayez	"	
JY5HWF	Widad Fareed	"	
JY5HWK	Waffa Abdull Ruhman	"	
JY5ICA	Mohamed Jamil	Irbed	
JY5ICB	Faroug Ahmad	"	
JY5ICC	Bashar Khasawneh	"	
JY5ICD	Mahmoud Yaseen	"	
JY5ICE	Hussein Assad	"	
JY5ICF	Bashar Nasor	"	
JY5ICG	Maren Samawi	"	
JY5ICH	Atef Khalil	"	
JY5ICI	Ibrahim Mustafa	"	
JY5ICJ	Mohamad Naji	"	
JY5ICK	Mutasem Maita	"	
KY5ICL	Madhat Mohamed	"	
JY5ICM	Ali Hatamleh	"	
JY5ICN	Walid Jiries	"	
JY5ICO	Fakhri Baker	"	
JY5ICP	Bassem Atia	"	

Call	Name	Town	P.O.B.
JY5KAA	Amal Amareen	Karak	36
JY5KAB	Aimen Burgan	"	30
JY5KAC	Amal Mawajdeh	"	36
JY5KAD	Amneh Sawadha	"	36
JY5KAG	Eiman Haddaddin	"	30
JY5KAH	Ahmad Al Masri	"	30
JY5KAI	Alia Mawajdeh	"	36
JY5KAJ	Akram Jamil	"	30
JY5KAK	Afaf Majali	"	36
JY5KAL	Intisar Majdi	"	36
JY5KAM	Adnan Khayat	"	30
JY5KAN	Aisha Mahadeen	"	36
JY5KAQ	Albert Qssous	"	30
JY5KAT	Amjad Madaita	"	30
JY5KAW	Abdull Wahab Madadha	"	30
JY5KBC	Bashar Halasa	"	30
JY5KBD	Bassam Dmour	"	30
JY5KFG	Vara Hadadeen	"	36
JY5KFM	Fatima Shamaileh	"	36
JY5KFZ	Fayez Zheimat	"	30
JY5KGA	Ghada Adhash	"	36
JY5KGO	Gharam Amareen	"	36
JY5KHC	Hassan Shamaileh	"	30
JY5KHK	Hayel Majali	"	30
JY5KHM	Hussein Mohamad	"	30
JY5KHR	Habes Rawashdeh	"	30
JY5KHY	Haifa Sona	"	36
JY5KIM	Imad Matarneh	"	30
JY5KJJ	Jamal Jamil	"	30
JY5KJM	Jamal Mahamad	"	30
JY5KJR	Jawhara Rida	"	36
JY5KJS	Jamal Sawalha	"	30
JY5KKA	Kifah Momani	"	36
JY5KKB	Khalida Salem	"	36
JY5KKC	Khadra Madadha	"	30
JY5KKH	Khaled Halasa	"	30
JY5KKK	Khaled Khreis	"	30
JY5KKI	Khitam Mowafi	"	36
JY5KKM	Khitma Madadha	"	36
JY5KM	Khasrouf Abdulla	Amman	
JY5KMA	Maysoun Madadha	Karak	36
JY5KMB	Marry Bqaein	"	36
JY5KMC	Marry Durzi	"	36
JY5KMD	Mohamad Dmour	"	30
JY5KMA	Marwan Hadaddeen	"	30
JY5KMI	Mikhled Ibrahim	"	30
JY5KMK	Mohamad Karoki	"	30
JY5KMM	Mansour Majali	"	30
JY5KNG	Nasser Gabari	"	30
JY5KRM	Radwan Mohamad	"	30
JY5KSA	Samieha Madadha	"	36
JY5KSJ	Shadia Jamil	"	36
JY5KSL	Samar Lafi	"	36
JY5KSM	Samir Ayed	"	30
JY5KSN	Salma Madadha	"	36
JY5KSR	Samih Rahaifeh	"	30
JY5KSS	Samah Samih	"	36
JY5KST	Samah Lafi	"	36
JY5KYA	Yousef Rmamin	"	30
JY5KZH	Khazar Halasa	"	30

Call	Name	Town	P.O.B.
JY5KZN	Zein Majali	Karak	36
JY5MAA	Awad Ababseh	Madaba	
JY5MAF	Ahmad Faiad	"	
JY5MAI	Azmi Anwar	"	
JY5MBH	Bassem Halasa	"	
JY5MCC	Chibli Salem	"	
JY5MGM	Ghassan Michel	"	
JYMHD	Haitham Dabaeen	"	
JY5MHF	Haidar Farah	"	
JY5MHM	Husam Masannat	"	
JY5MHQ	Husam Qsous	"	
JY5MIH	Ihsan Hamameh	"	
JY5MIW	Ibrahim Wahsh	"	
JY5MKH	Kholoud Hamarneh	"	
JY5MMS	Michel Sahouri	"	
JY5MMT	Marwan Twal	"	
JY5MNC	Nawaf Shawabkeh	"	
JY5MRM	Rajai Matalga	"	
JY5MSM	Samir Marzoug	"	
JY5MSO	Saleh Oran	"	
JY5MSQ	Soheil Qunsul	"	
JY5MT	Mrawed Altel	Amman	
JY5RAC	Akram Abou Shaar	"	
JY5RAH	Ahmad Hasant	"	
JY5RAS	Ahmad Suleimann	"	
JY8RBM	Bader Mustafa	"	
JY5RDH	Oaifulla Hamdan	"	
JY5REM	Eid Mazahreh	Zarqa	
JY5RFK	Fahmi Khalaf	"	
JY5RGM	Grayed Mujali	"	
JY5RGT	Ghazi Twaise	"	
JY5RIK	Issam Kawar	"	
JY5RIS	Ibrahim Sodah	Amman	
JY5RMA	Mohomad Armouti	"	
JY5RS	Shukri Antoon	Zarqa	
JY5RST	Samih Talab	Amman	
JY5RUA	Yousef Suleiman	"	
JY5SA	Saleh Atiyat	"	
JY5UAA	Abdull Jalil Musa	"	13016
JY5UAH	Ahmad Haroon	"	"
JY5UAK	Ahmad Khateeb	"	"
JY5UAN	Abdull Munem Nweerat	"	"
JY5UAT	Ahlam Taher	"	"
JY5UFA	Fawzi Ali	"	"
JY5UHH	Husam Hashem	"	"
JY5UKS	Khawla Suleiman	"	"
JY5UMA	Mohamad Mahmoud	"	"
JY5UMD	Mahmoud Issa	"	"
JY5UMH	Mohamad Harbi	"	"
JY5UMI	Mahmoud Rifai	"	"
JY5UMM	Muner Mansour	"	"
JY5UMN	Mahmoud Nugrush	"	"
JY5UMR	Mahamad Radi	"	"
JY5UMS	Mahmoud Said	"	"
JY5UMY	Mohamad Younes	"	"
JY5UNM	Naef Mohmoud	"	"
JY5UTB	Taiseer Belbaise	"	"
JY5UTH	Taha Hussein	"	"
JY3ZH	Zeidan Hussein	"	"
JY5ZS	Zuhair Shaer	"	"

CLUB STATIONS

Call	Club	Location	P.O.B.
JY6AC	The Royal Automobile Club	Amman	
JY6AS	The Arab Revolution School	Zarka	
JY6FC	King's Faisal College	Amman	
JY6GC	Aqaba (OM) Youth Center	Aqaba	
JY6HC	Al Hussein Youth City	Amman	
JY6HS	Al Hussein Secondary School	Zarka	32
JY6IC	Irbid (OM) Youth Center	Irbid	
JY6KG	Al Karak (OM) Youth Center	Alkarak	30
JY6KW	Al Karak (YL) Youth Center	Alkarak	36
JY6MC	Madaba (OM) Youth Center	Madaba	
JY6RS	Royal Signals Officers Club	Zarka	
JY6UJ	University of Jordan	Amman	13016
JY6ZZ	Royal Jordanian Radio Amateur Society	Amman	2353

Joseph M. Steim WA1OMS
125 Freeman Parkway
Providence RI 02906

IC REPEATER LOGIC SYSTEM

Switch repeater functions in a proper, controlled sequence with this solid-state control unit.

Reliability is the prime consideration in repeater control logic. Malfunctions in control logic can usually be traced to an electro-mechanical device such as a relay or motor. Quite simply, if a control logic system does not contain any electro-mechanical devices, there aren't any that can malfunction.

This article will describe a totally solid-state logic system using relays in only the COR and B+ line feeding the transmitter. I should mention that this article will provide sufficient information to duplicate the logic system described herein, but will leave details of interfacing it to existing equipment and the like to the builder. I assume that anyone building a repeater has quite an adequate level of technical competence.

Having been influenced by common practice in repeater design in the New England area, the design has been made to conform to the following set of criteria:

1. A 3-minute time-out function which never resets until both the COR resumes an idle state and the repeater carrier leaves the air.

2. A squelch tail length of about 3/4 seconds.

3. A solid-state identifier which initiates only upon departure of a signal from the receiver. This system is differentiated from those which allow the ID to operate during someone's transmission. Identification during transmission is undesirable because it either interferes drastically with the speaker or it necessitates reducing the ID to such a low level that the repeater call becomes nearly illegible. Identification occurs at intervals of 2.5 minutes, and only during

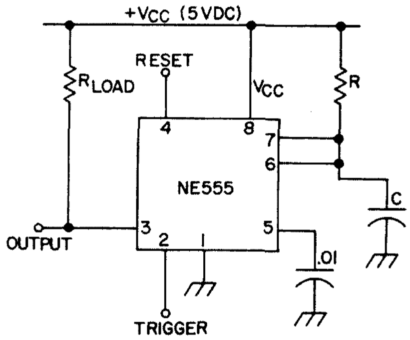


Fig. 1. General connnection diagram of NE555.

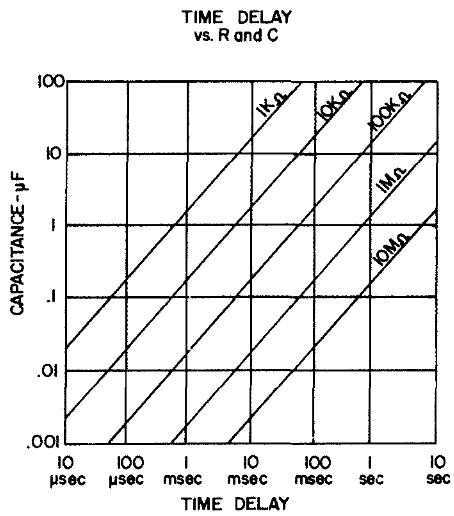


Fig. 2. Time delay nomogram.

periods of use; i.e. the repeater never turns itself on to identify.

4. A timer which holds the transmitter on for an especially long tail during identification so the ID may be allowed to complete itself before the transmitter leaves the air.

5. A slight 3/4 second delay between departure of a signal from the receiver and initiation of the ID. This delay will compensate for the rather long transition times from transmit to receive in some new solid-state rigs. It permits someone who has immediately stopped transmitting to hear the ID without missing the first few characters as a result of long transition time.

6. Operation at reasonable current requirements from a single 5V dc supply for both logic and ID.

7. Ability to interface without major modification to existing repeaters using relay logic.

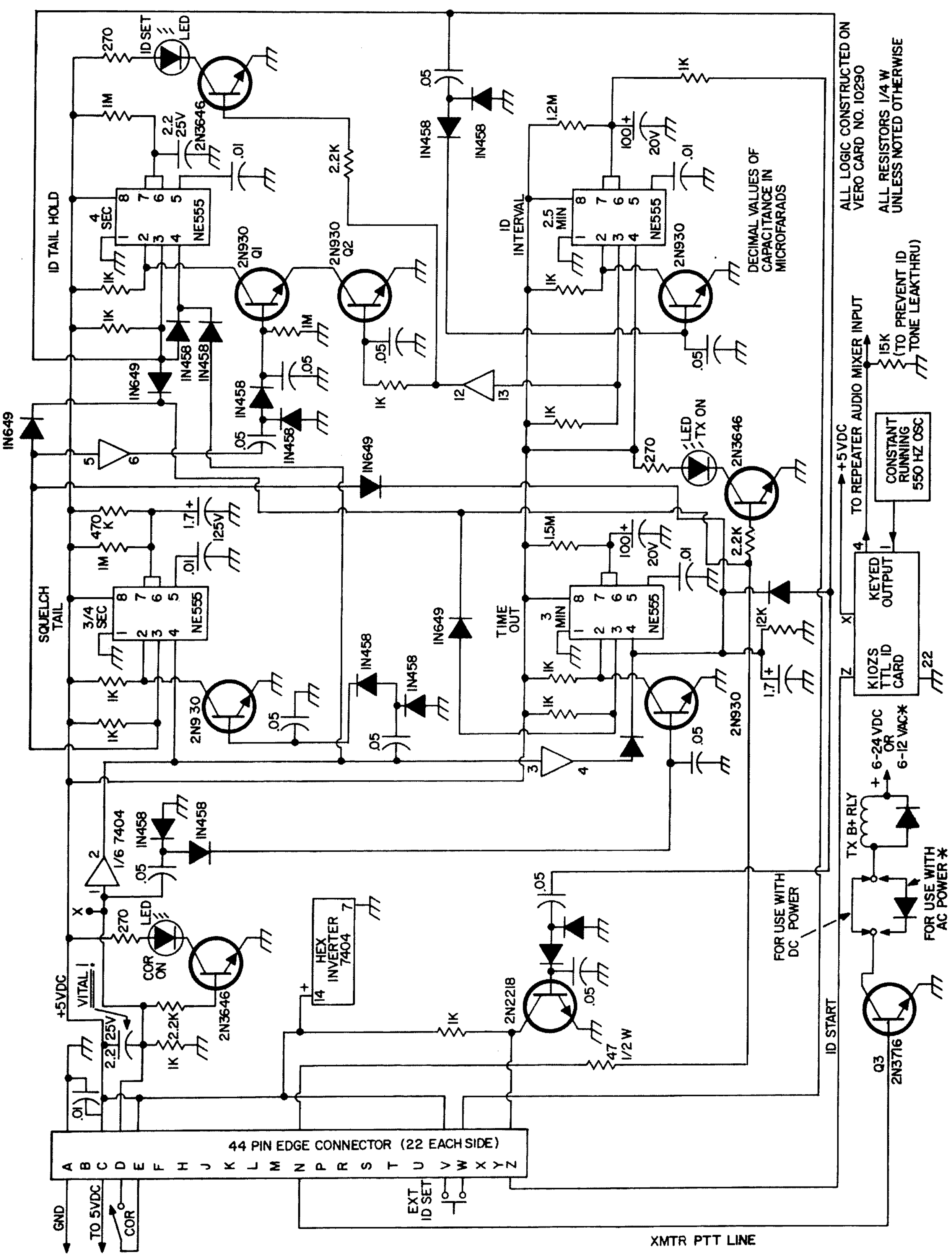
The control logic design centers around an IC which has been recently introduced by Signetics, the NE555. Although it is available in two package styles, the DIP, designated by the V suffix, is probably the most convenient, since all the rest of the IC's in the design are in the dual-inline configuration. The NE555V is useful not only as a resettable timer, but also in a variety of other applications, including monostables, astables, and missing pulse detectors. For those of you who wish a more thorough description of the machinations of the IC, Signetics offer a seven page set of application notes. I will, however, present a description here of the way in which the NE555V is used in the control logic design.

Figure 1 depicts use of the NE555V as a resettable timer. Whenever the voltage on the trigger input, pin 2, goes below 1/3 Vcc, the voltage at the output of the timer, pin 3, will assume a condition of logical 1 for a period of time determined by R and C. The timer is reset, i.e. the output voltage is brought to zero, when a negative pulse is applied to the reset terminal, pin 4. The timer will not be retriggerable until the logical 0 voltage at the reset pin is restored to logical 1. In all cases in the control logic design, the NE555V's are used in the resettable timer mode. The correct values of R and C for the time constants designated in the control logic design are given. However, depending upon the particular builder's tastes, these values may be altered according to the nomogram shown in Fig. 2.

Circuit Description

The three-minute time-out timer commences its timing cycle immediately upon receipt of a signal in the receiver. The output of this timer feeds the B+ relay driver transistor, Q3, through a simple 3 input diode OR gate (see Fig. 3). When the signal leaves the receiver, the 3/4 second squelch tail timer is triggered, raising its output to logical 1, and holding the transmitter on until its timing cycle is completed. In the meantime, the three-minute time-out timer has been prevented from resetting by a second 3 input diode OR gate connected to its reset terminal. The reset voltage at pin 4 of the time-out timer is held at logical 1 until the repeater carrier leaves the air.

Until this point we have considered operation of the logic divorced from the timer which controls the interval between identification and the timer which provides an extra-long tail to allow the ID to complete itself without interruption. Now let us see how these timers work. Consider a situation where the repeater has been idle for some time. The 2.5 minute ID interval timer has its output at logical 0 since its timing cycle has been completed. After passing through the phase inverter associated with pins 13 and 12 on the 7404, this voltage is converted to logical 1, enabling one input, namely Q2, of the discrete transistor AND gate consisting of Q1 and Q2. A signal appears on the repeater input, starting the time-out timer. Then the signal leaves, and the squelch tail timer starts. The negative-going pulse arising from the squelch tail timer returning to logical 0 is changed to a positive-going pulse by passing through the phase inverter associated with pins 5 and 6 of the 7404. This positive-going pulse is applied to the second input, Q1, of the AND gate, Q1 and Q2. Since the first input of the AND gate has already been enabled by the ID interval timer, the ID tail hold timer commences its timing cycle. Along with keeping the transmitter on, at the beginning of its 4 second timing cycle the ID tail hold



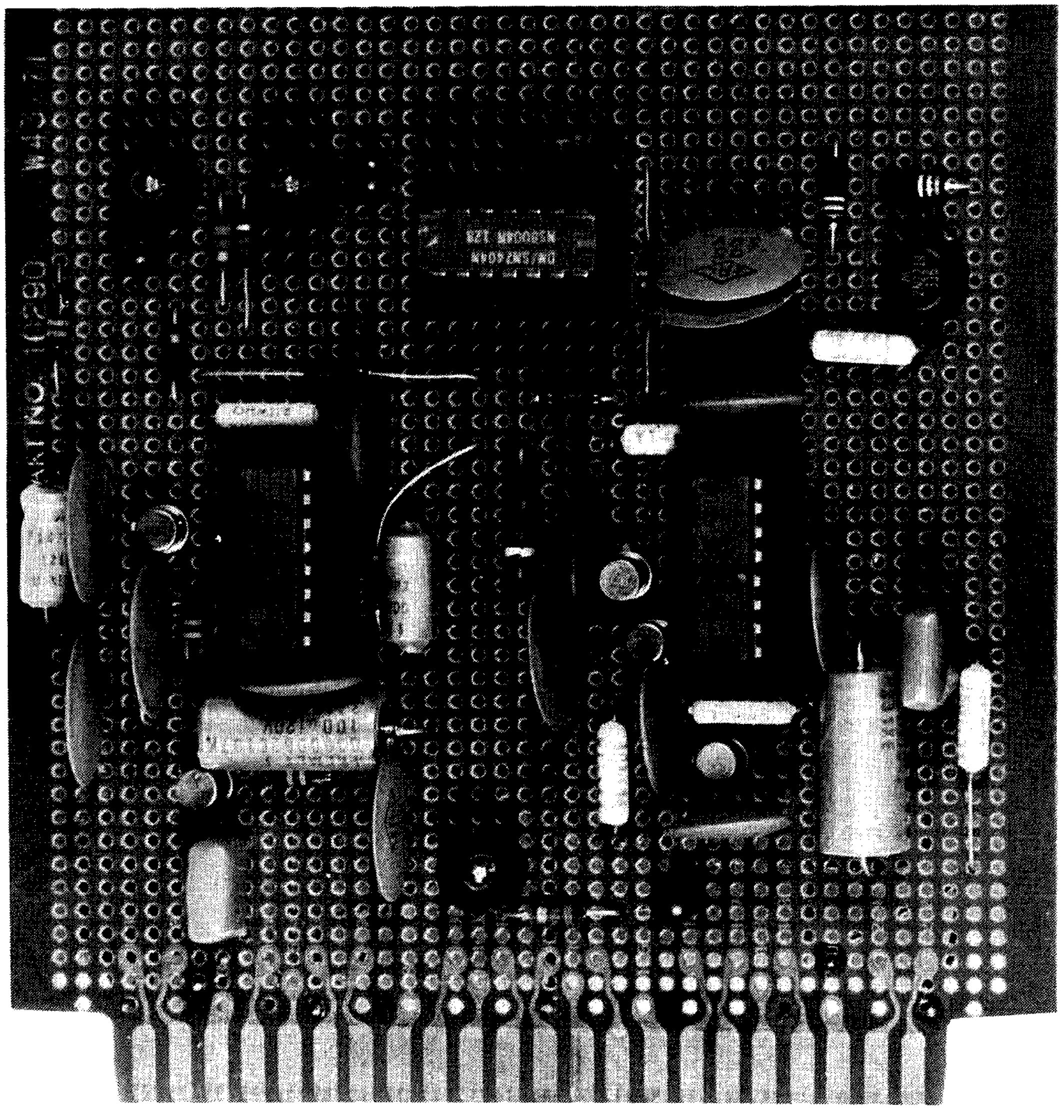
ALL LOGIC MUST BE OPERATED WITH <u>VERY WELL REGULATED</u> 5V SUPPLY
ALL CARDS SHOULD BE SHIELDED AND BYPASSED TO KEEP RF OUT

Fig. 3. Schematic of complete logic system.

timer sends an initiate pulse to the ID and retriggers the ID interval timer. Finally, one must consider the source of the delay mentioned earlier between departure of a signal from the receiver and initiation of the ID. Recall the timing sequence when a signal leaves the receiver. First the COR drops out, then the 3/4 second squelch tail timer drops out, in turn triggering the ID tail hold timer which then starts the ID. The same 3/4 second squelch tail timer provides the delay in starting of the ID.

This design is an example of pulsed sequential logic. The signals delivered by the COR and the output circuits of the timers are of constant amplitude, and must be converted to momentary pulses. To accomplish this, a one-shot of some sort is required. Bear in mind that a discharged capacitor has essentially zero resistance. When it becomes charged, the resistance increases to nearly infinity. The circuit in Fig. 4 employs this principle in a simple diode-capacitor one-shot. A positive-going signal at the input will deliver a momentary positive pulse through CR1 at the output. The one-shot is reset when the input signal returns to zero, thus discharging the capacitor through CR2. This positive-going pulse is of no use in triggering the NE555V until it passes through a phase inverter consisting of an NPN transistor and a IK pullup resistor. A similar circuit is used to start the ID. The ID intended to be used with this system was designed by K1OZS. It, like the NE555V, requires a negative pulse to initiate.

There are several convenience features incorporated into the logic system. Three LED's are mounted on the card to provide a visual indication of the operating condition of the repeater. The first illuminates when the COR is on, thus acknowledging receipt of a signal. The second LED is on whenever the repeater carrier is on the air. The third LED, and perhaps the most useful of the three, shows when the Q2 input of the AND gate in the ID triggering circuit is enabled. Hence it indicates the ID is set to operate. This LED will extinguish when the ID starts, demonstrating that the ID is no longer set. It will reilluminate in 2.5 minutes, when the ID interval timer has completed its timing cycle. A provision is included for externally reset-



Photograph of completed logic card. This photo was taken before the half-volume was added. With edge connectors at bottom, the ID set LED appears in the foreground. Upper left LED is COR on. Remaining LED is transmitter on.

ting the ID interval timer so that the entire ID sequence, including the ID tail hold timer which keeps the transmitter on during identification, can be controlled manually. Similar additions, such as ability to manually time out the repeater, may be added, but are left to the constructor's judgment.

Construction

The entire logic system, exclusive of the ID, which occupies another card, fits in somewhat less than 3/4 of a standard size Vector card. Vero also makes a card suitable for this; its part number is 10290. Both cards are designed to mate with a 44 pin edge connector. Layout is straightforward, as can be seen in the photograph. Since each NE555V is an 8 pin DIP, two of them fit nicely in a single 16 pin DIP socket. The details of construction are left to the builder. I prefer not to bother with pins to mount components. The photograph should provide more than adequate ideas for construction. The ambitious among you may want to lay out a PC pattern.

Miscellany

As with any design involving high speed pulsed logic, rf can be a problem. The TTL series 7404 as well as the NE555V are, however, remarkably noise immune. Despite their noise immunity, additional precautions should be taken to avoid possible difficulties. All bypass capacitors shown in the diagram are the absolute minimum number for successful operation, but if you are plagued by rf don't hesitate to experiment with .01's anywhere in the circuit. They can't

do any harm. All cards containing logic, i.e. control logic and ID, should be completely shielded in a metal enclosure. Leads interconnecting the logic to other parts of the repeater should pass through the enclosure walls only through feed-through capacitors. Leads should also contain small chokes of about 10 μH mounted as close as possible to, or perhaps right on, the logic card. The 2.2 μF capacitor mounted across the COR contacts is absolutely essential to eliminate problems induced by contact bounce in the relay. With these precautions, the logic will perform perfectly.

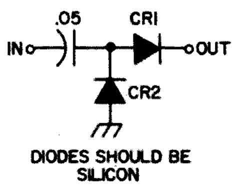


Fig. 4. Diode–capacitor one-shot.

Transistor and diode part numbers referred to on the schematic are not critical. Replacements should have similar characteristics to those which were suggested.

The capacitors used in the timing circuits, designated by C in Fig. 1, should be tantalum or Mylar for stability. Most others may be disc ceramic.

As pointed out earlier, the identifier mentioned throughout the article was designed by K1OZS. The triggering circuit used in the logic system will work with the K1OZS ID, but may require modification to work with other identifiers. Details of this modification are again left to the constructor, since design characteristics will vary for different ID's. The output circuit of the K1OZS ID uses a small picoreed relay, which can quite easily be made to key the output of a constant running audio oscillator. The small size of the picoreed relay causes a certain amount of capacitive leakthrough, which results in a trace of ID oscillator voltage appearing on the repeater carrier at all times. This condition is completely cured by placing a 15K resistor in shunt to ground with the line going to the repeater audio mixer from the ID. Systems using low impedance audio mixers may not experience the problem at all since the input impedance of the audio system is already low enough to eliminate capacitive leakthrough difficulties. Alternatively, what is known as a half-volume circuit may be used to do away with the problem. This circuit reduces the ID level by about 3 dB when a signal appears in the receiver so that someone who accidentally starts transmitting over the ID will not be obscured by it. As an added benefit, its shunt impedance is also low enough to eliminate capacitive leakthrough problems. Such a circuit appears in Fig. 5. These few components would easily fit in a small portion of the unused space on the control logic card. There would still even be room for putting a Twin-T network audio oscillator for the ID.

The output of the logic system provides positive 3V for the relay driver transistor, more than sufficient to saturate it. The relay driver transistor suggested, a 2N3716, is capable of switching up to about 30V at several amps, positive only with respect to ground. The schematic shows an option for operation of the B+ relay coil from ac. It is necessary only to insert a diode, properly polarized, in series with the relay coil.

Again, those of you who are ambitious may want to replace the electro-mechanical COR by a solid-state Schmitt trigger, using perhaps a TTL series 7400. In addition, Delco now offers transistors suitable for controlling low to moderate transmitter plate voltages and capable of operation at 700–800V dc. Possibilities suggest a totally solid-state repeater logic system. Imagine a repeater that is completely silent! I had originally displaced thoughts of a completely solid-state system, since one of my objec-

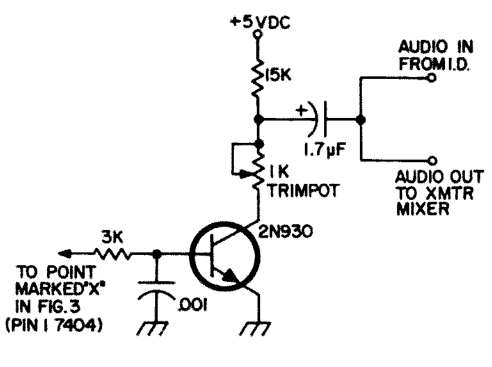


Fig. 5. Half-volume circuit.

tives was to enable the design to be interfaced with existing repeaters using relay logic. The objective has been maintained. A repeater using relay logic can have the logic system described in this article installed in it in a matter of minutes, because the old COR and B+ relay are used. Yet for new repeaters there is no such restriction. The nature of the design permits it to be integrated into a totally solid-state system.

The logic system and ID should be operated from a well-regulated and filtered 5V dc power supply which is free from transient noise spikes and other extraneous outputs. A Thyrector diode across the primary of the power transformer should eliminate unwanted noise resulting from power line pickup. The voltage from the power supply must be constant or the ID speed will change. Such a supply is not difficult to construct. Suitable designs appear in *The Radio Amateur's Handbook*, many hobby circuits manuals, and magazine articles. Several surplus electronics houses offer complete 5V supplies intended specifically for use with TTL logic. The power supply for the logic should be capable of at least one amp.

Testing the completed circuit consists of plugging it in, turning it on, and seeing if it works. Chanes are that if it doesn't pass the smoke test, you'll never be able to tell visually, since it contains no high voltage or high current components to be visibly damaged by a malfunction. Malfunctions will be traceable to either a faulty component or a wiring error. The design has proven itself inherently flawless over several months of 24-hour service. The operation of the system is described in detail earlier. When you take it upon yourself to start this project you should, as with any other, be prepared to repair the finished product if it doesn't work. This article is not intended to be a troubleshooting manual.

At maximum, there are only two adjustments to be made to the system. The speed of the ID should not be permitted to exceed the 20 wpm legal limit. If the half-volume circuit is included, its 1K trimpot should be manipulated so that the ID level is reduced by about 3 dB when the COR is active, i.e. when a signal is present in the receiver.

Conclusion

With this system replacing relay logic, you can bid farewell to sticking relays, timers which either don't work at all or don't reset, and scratchy code wheel identifiers.

The system lends itself to interfacing with a TTL sequential tone decoder for remote control purposes. I am currently perfecting a circuit which can be added to the logic system without modifying it, to allow for complete remote control of the repeater. It employs another Signetics IC, the NE567. Almost any other remote control system, using either relays or solid-state logic, may be interfaced with this logic design. Anyone starting construction on a new repeater should explore the solid-state COR discussed earlier.

I am confident anyone using this design will be pleased with its operation and rewarded with trouble-free operation for building it.

Acknowledgements go to K1ABR, K1BCT, K1OZS and WIOAV.

...WA1OMS

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MONO - BAND LOG - PERIODIC ANTENNAS PART II

Last month the theory and design of single band Log-Periodics was discussed and element lengths were presented for five-element L-Ps for the HF bands 80–10m. This month we will conclude the article with the method of construction, erection and tune-up of these antennas.

Construction

Figure 3 illustrates the homemade 1.5 x 7.5 cm Lucite center insulators. These support and space the two-wire center feed line which feeds the elements and separates or positions the five elements. These can also be used as end insulators for elements 2, 3 and 4. Egg-type insulators are used for elements 1 and 5 as will be mentioned later.

W4ITS has been experimenting with L-Ps lately and suggests that pieces of ½ in. (std) plastic water pipe serve well for insulators and are less expensive and easier to construct.

Figure 4 illustrates the completed monoband L-P supported between four masts, showing the method of using two nylon catenary side lines for supporting the elements. This sketch is shown looking down on the complete system.

My lastest Log-Periodics are constructed entirely of aluminum wire which is used to reduce weight and cost. This is No.15 aluminum electric fence wire which can be purchased at Sears and is much less expensive than any copper antenna wire. The use of aluminum wire is important for weight reduction of my L-Ps since they are all supported by high trees. If masts were used, No.14 or 7/22 copper antenna wire could be used; however it is quite a bit more expensive.

Assembly

First cut and drill the Lucite per Fig. 3. Three of the center insulators (4-holes) and six of the end insulators (2-end holes) will be required for elements 2,3 and 4.

Next cut two wires slightly longer than the overall length given in the table last month for the two-wire center parallel feed line. Thread the three center insulators on one end of the two wires (close spaced holes).

Select two trees, posts or other rigid supports separated by a meter or two greater than the final length of the feed line. These

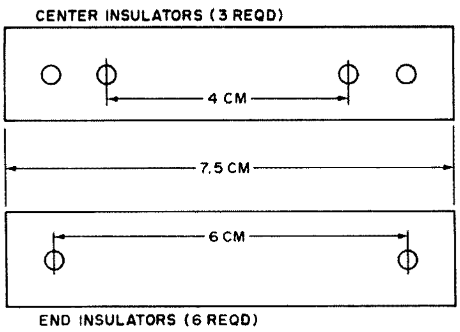


Fig. 3. The centered end insulators are made of Lucite approximately 6 mm thick. All holes are made with a No. 29 drill.

should be at least 1.5 meters above ground between which the two-wire center feeder can be strung and pulled tight.

With the two-wire feed line secured to and made tight between the two supports, mark a starting point (about 30 cm from one of the end supports). This can be indicated by a piece of plastic tape or masking tape secured to each of the two parallel wires (or a quick-drying paint smear can be used). This will be the starting point or the location of the No.1 rear (longest) element. Note: An egg-type insulator will be used as the center insulator for the rear element 1 and the forward element 5. Lucite is not suited for these two end elements as there is more strain on these than elements 2,3 and 4.

Starting at the marked point which will be the center connection for element 1, measure along the parallel feeders with a steel tape to obtain the first spacing distance (S1) between elements 1 and 2. Now slide a Lucite center insulator to this point. The other two insulators must be forward of the element 2 center insulator. Using a short length of No.18 or 16 tinned copper hook-up wire, secure the Lucite center insulator or spacer to the two parallel feeders as illustrated in Fig. 5. Make certain the Lucite spacer is square or at right angles to the feeder and that the tension is equal on both wires. After the first spacer is secure, proceed to the next.

Measure the second spacing distance (S2) which will be the distance between element 2 and 3. Slide the second Lucite spacer into position and secure, being sure the third spacer is forward of the second.

Now measure S3 and secure the third spacer, then measure S4 or the last spacing between E4 and E5 and mark with tape or paint. This will be the location for the egg center insulator for the short forward element 5 and also the feed point.

Measure a length of antenna wire for the longest rear element 1. Since this is in effect a doublet, the length on either side will be one-half the length given in the table. Allow sufficient length on both ends for securing to the center and the end insulators.

The two-wire center feeder line will be attached across the center (egg) insulator of element 1. The feeder can be spaced or fanned out to about 8 cm at the center which will give greater spacing. This gives better mechanical stability to the two parallel feeders and there will be less possibility of these two wires becoming twisted or shorted in a wind. The lower bands, 40 or 80m L-Ps, may require one or two extra Lucite spacers to reduce the possibility of shorting in a high wind. A spacer every 2 meters may be necessary. These will generally not be required after element 2 or 3. None should be required for 10, 15 or 20m L-Ps.

Next, measure the two wires for element 2. As this element will be transposed at the Lucite center insulator, leave at least 30 cm extra on the center ends, beyond where they are secured to the end holes. This extra length or "dress" will allow for the transposition below the Lucite insulator.

Measure and cut element 3. This element is non-transposed at the center.

Measure and cut element 4. This will be transposed as per element 2.

Measure and cut the shortest forward element 5. This is non-transposed and also uses an egg center insulator as used for element 1.

The two-wire parallel center feeder can now be removed from the two end supports and for the moment can be laid on the ground. We now have the center feeder spaced by the three Lucite insulators for elements 2,3 and 4, and it is ready to be connected across the two egg insulators at elements 1 and 5. The two-wire feeder should be 30 or 40 cm longer at each end (beyond the rear and forward marked

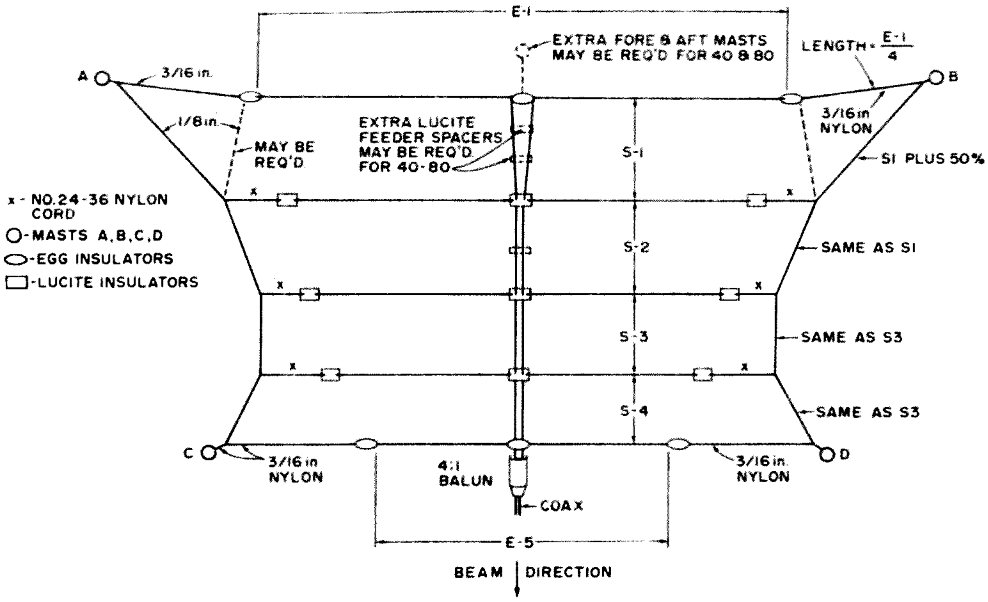


Fig. 4. Basic layout of the L-P antenna once the insulators and supporting ends have been attached.

points). These extra lengths leave sufficient length for wrapping to the center of elements 1 and 5. After wrapping, the extra length is cut off. We now have the center feeder connected to the five elements.

Regarding transposition of every other element, note that the odd elements 1, 3 and 5 are *non-transposed* while even elements 2 and 4 are *transposed.*

We are now ready to assemble the entire antenna. It is assumed that the four masts, trees or other supports to which this beam is to be suspended and aimed in the desired direction have been selected or erected.

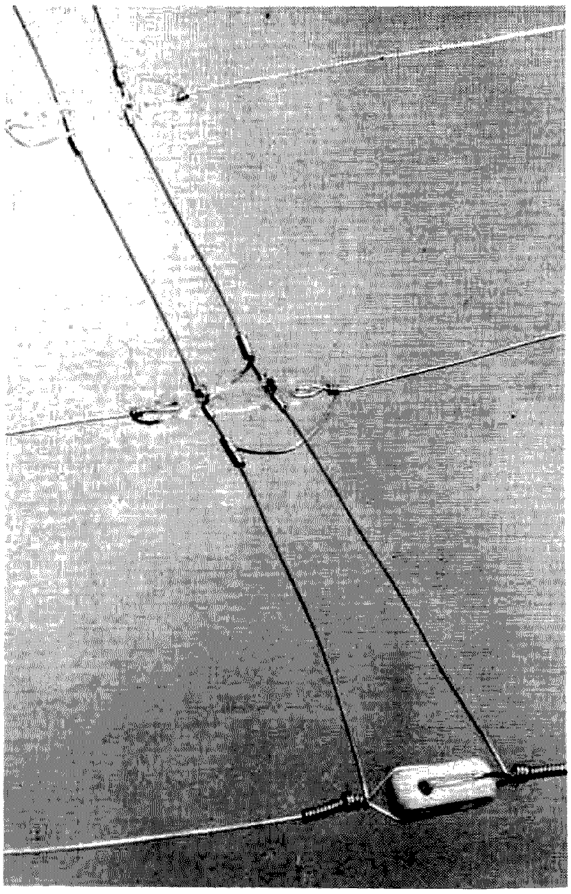
The entire antenna will first be temporarily assembled between the four masts at a height of approximately 2 meters. This height is suggested as the system can be stretched at the low height between the four masts to clear the ground and can still be reached for making the connections between the elements and the center feed line. If the beam is to be for 80m it may be necessary to assemble it approximately 3 meters off the ground, using a stepladder.

With the five elements and the two-wire center feeder laying on the ground in the desired aiming direction, string the two catenary side lines (A-C and B-D) fore and aft between the supports.

Next add the end insulators to the five elements and to these tie on the nylon support cords. Egg-end insulators are used for the rear and forward elements 1 and 5; Lucite end insulators for elements 2, 3 and 4.

Stretch element 1 between supports A and B and element 5 between C and D. Now, by having the two side catenary lines stretched between the masts (line 1 between A and C; line 2 between B and D) at a working height, it is fairly easy to adjust the tension between the elements and the side lines so they (catenary side lines) will take on the proper shape illustrated in Fig. 4. While making these adjustments, it is suggested that the nylon cords between elements 2, 3 and 4 end insulators and the catenary lines be tied to the catenaries with an easily untied knot, as it may be necessary to adjust these several times for proper weight and tension distribution so the side lines will take on proper shape. This is the only "cut and try" procedure required for assembling this type L-P.

Care should be taken at this point to keep the elements parallel with each other, i.e., the end separation between the elements should be equal to their center spacing distances, S-1, S-2, etc. There will be some



This is a mock-up showing three elements to illustrate proper connections to the forward or aft egg center insulators (non-transposed). The following element using the Lucite center insulator is transposed and the third insulator is non-transposed. These mock-up elements were only spaced 25 cm so the three types of center connections to the feed line could be illustrated in a single photo.

sag to elements 2, 3 and 4 unless their supporting cords to the catenaries are very tight. Some sag in these elements seems to have little if any effect on the antenna's performance. It is probably better to have some sag than to put too much strain on the end cords and in turn the side lines. Allow some "give" to reduce possibility of damage during an ice storm.

There will also be some fore-and-aft sag to the center feeder due to the weight of the two-wires and the center insulators (especially if copper wire is used). The amount of feeder sag will also depend on how tight the rear and forward elements can be tightened between their supports, as they support the weight of the center feeder. If copper is used for the center feeder, it may be necessary to also have two additional fore-and-aft supports, especially for 40 or 80.

After all mechanical adjustments have been made at a convenient height, it should "hang" or be stretched in exactly the same configuration it should have when raised. If it now appears satisfactory, the element end cords can be firmly secured to the side catenaries. After these are secured with a non-slip knot, a few wraps of masking tape should be applied to either side of the element cords to keep them in position.

If copper wire has been used, all joints should now be soldered. The 4:1 balun should be added to the forward short-end feed point.

Before hoisting the antenna to position, it is suggested that an swr check be run. Connect a short length of coax to the balun and read the swr across the band every 100 kHz.

Even though the antenna is only 2–3 meters above ground, the swr readings taken at this height will not be too far off from one taken after the antenna is raised to maximum height. This procedure would probably not be accurate for a yagi or other narrow band, high Q beam, as there would be too much ground effect. An L-P, being a low Q broad band antenna, seems to be less affected. It is suggested that the swr readings be recorded for comparison with the final swr test which should be run after the antenna is raised to its final location.

Another interesting test while the antenna is at a workable height it to excite it with sufficient power to get an rf indication at the element ends, using a small neon bulb or a "sniffer" to check the voltage distribution on the elements and center feeder.

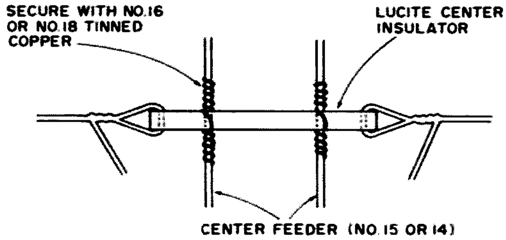


Fig. 5. Method of securing the center insulators to the center feeders.

Rf will be practically nil on the rear element 1 (reflector). The second element will be quite "hot", as it should be, and rf will generally diminish on the three forward elements. At the high end of the band, 3 may become the "active" element and 2 the reflector. This simple voltage distribution test is especially interesting on a long 12–17 element L-P for 20-15-10 when testing on each of the three bands.

If the low elevation swr is less than 1.5:1 and relatively flat across the band, the coax to be used can be connected and the beam raised into place for on-the-air tests.

Some have inquired as to how these L-Ps stand up under icing conditions and during high winds. Although all of my L-Ps, including those for 20-15 and 10 are suspended by high pines and cedars, I have had no problems to date. The first L-P installed in 1970 is still up. It and several others have been through three heavy ice storms. Although they sagged almost to the ground from ice buildup, none broke. The nylon line used for their support evidently has enough "give" under the load to prevent snapping. As soon as the ice melted, they returned to their normal height. The only antenna I have lost here during an ice storm was an 80m doublet – but so far, no L-Ps. They have also been through several high winds successfully.

There have also been inquiries as to whether the mono-band L-P can be designed for a higher gain than 10 dB. The gain of a Log-Periodic is determined by several variables as were outlined by Reference 5. Of these the α angle (½ the apex angle), the "boom length" and the number of elements, are important factors. The smaller the apex angle, the longer the boom length and more elements (up to a point) gives greater gain.

Some of the large fixed commercial and military hf Log-Periodics give gains up to 14 dB. One manufacturer produces a modified type L-P only 60 meters in length which has an advertised gain of 17 dB.

Working with these variables is more complex and lengthy than can be presented here. Without a programmed computer, the designing of an L-P by the formulas can become quite involved. I have, however,

worked out a graphic design method for L-Ps which requires absolutely no math except for simple division. By using this method, any 3 to 30 MHz, VHF or UHF L-P can be designed on paper in less than an hour, where several days were required before. My largest 17-element 20-15-10m L-P, which is 30 meters in length, giving 12 to 13 dB gain, was generated by the graphic method.

I am now assembling an experimental "Long-John" mono-band L-P for 20 which will have seven or nine elements and should give 15 dB gain. If this gain is realized, I plan to add a second identical L-P to give two side-by-side (co-linear) in phase beams to obtain an additional 3 dB or a total of 18 dB. I have tried this previously with a temporary dual L-P and was able to get the additional 3 dB gain by phasing. If this works out over a test period, I will be glad to pass on the information.

. . .W4AEO

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If you've added a tunable oscillator to your 2m FM rig, the next step is

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CALIBRATING YOUR TUNABLE 2 METER RECEIVER WITH SURPLUS CRYSTALS

This article describes the use of either old or new crystals in the 8 MHz band, such as from Gonsets or similar, for calibration purposes. An infinite attenuator is also described as a bonus for signals from .1V down to .1 μV, and even .001 μV if you think your receiver can pick that up. This is good for both sensitivity and low noise tests. You can also borrow crystals from a buddy to help calibrate your dial. Looking back into the Gonset portion of my junk box, I found some 8 MHz rocks that did the job, and multiplied them into the 2 meter band from 144 to 147.819, so the 2 meter FM band was easy to find.

Now, a crystal oscillator in the 8 MHz band is easy. Or is it? Sure, they've been around since before World War II, but just wait until you try it. There are pitfalls waiting for you such as high-power spurious and drop-outs with some crystals because – while they can be made to oscillate well – you have to change the circuit slightly, and that's no good for a general purpose calibration-signal generator-attenuator.

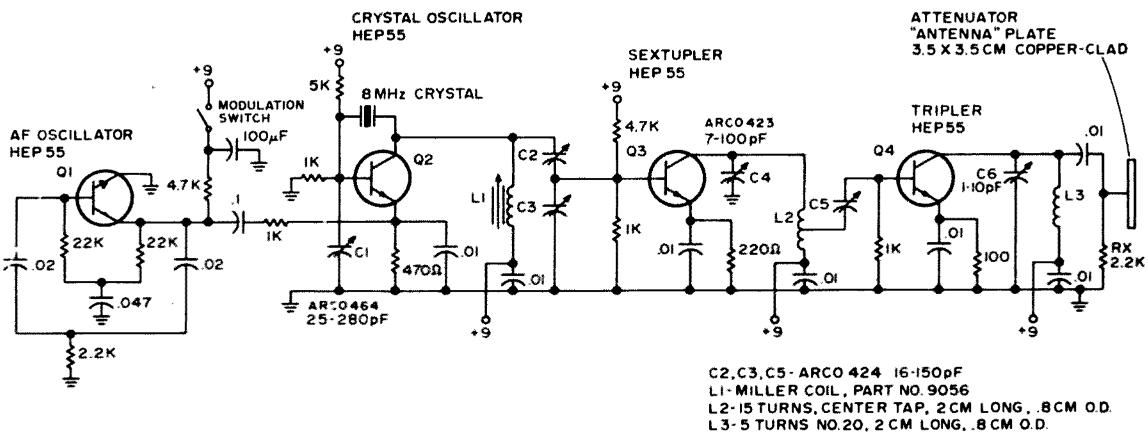

Fig. 1. Schematic of the receiver calibrator for the 2m band. L1 – Miller coil, part no. 9056; L2 – 15 turns, center tap, 2 cm long, .8 cm O.D.; L3 – 5 turns, no. 20, 3 cm long, .8 cm O.D.

It took me a good two days, 12 or 13 hours per day, to get this one running smoothly with most of the old crystals, and a smooth-running job is always a must with me. Here's hoping my experience will save you some time.

I first tried my favorite VHF circuit for the oscillator, which turned out to be much too lively. So back to the old "No-coil" Pierce I went, and after plenty of tries, the circuit shown in Fig. 1 was the result. It is very reliable and easy to tune up. It was built on a narrow plank for insertion into my trusty old Infinite Attenuator, a piece of waveguide 60 cm long by 11.8 cm wide and 7 cm high, which has a metal cap and jack on one end, as in Fig. 2. An insulated pick-up plate inside the waveguide attached to J1 allows you to connect your receiver cable to the receiver, *et voila*, signals from 100,000 μV down to 1/10, 1/100, or even less!

I included an af oscillator, which helps to identify the signal, and although this is not absolutely necessary when you use the infinite attenuator, at times it can be very useful. A money saver is a piece of rectangular cross section aluminum rain-gutter down lead (Fig. 2). This can be used instead of the waveguide, which not everybody can scrounge.

Special Notes

There is a certain amount of balance in tuning up an oscillator of this kind between

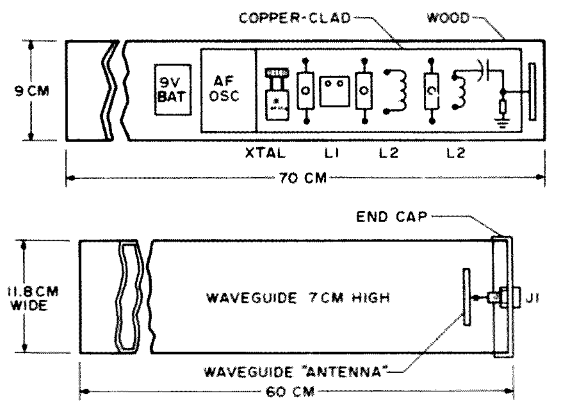

Fig. 2. Pictorial layout of the calibrator and infinite attenuator. Aluminum rain-gutter down lead of similar dimensions may be used in place of the waveguide.

the emitter resistor and the collector tuning, because of the variable capacitance effect of almost all transistors. Also, don't expect every crystal to work just the same way. They don't! I have one that could not be made to play along with the others. Make sure, with a tuned diode receiver, that you are on 8 MHz (very important). Most "dippers" when used in the diode mode and link coupled to the oscillator will do a good job for you. Do not use a high-sensitivity receiver for this purpose. You have to have at least one piece of test equipment on your bench for this sort of work, and that is a signal generator. A $40 one will do. This will enable you to calibrate diode receivers, etc. I have these things here from 50 kHz to X band, 10 GHz, and they are very handy when you need them. After checking the frequency of the crystal oscillator, I put in an untuned diode across the circuit of the output on 144 to 148 MHz. With this you can watch the rf output, and listen to it, without having to tune again. But always watch that frequency! When multiplying by large numbers, even tripling, it is very easy to slip into the next harmonic, and then see what happens if you don't realize it.

AF Oscillator

Referring to Fig. 1, and starting with the af oscillator, you see the familiar Twin-Tee job, which oscillates near 400 Hz with the values shown. All you want is some tone on the signal in order to identify it. You can connect it in almost anywhere on the crystal oscillator. It works fine on the emitter, so that is where it stayed. For more modulation, connect it to the base, possibly through an rf choke. A switch in the 9V line should be used to cut off the modulation. Do not try to simply disconnect the oscillator while it is running, as some modulation will sneak in through the battery's internal resistance. You could use a 100 μF capacitor across the +9V, but it is not really needed. The easiest way to disconnect the af oscillator is to just turn it off.

Crystal Oscillator

The final circuit is a combination of a Pierce, with the crystal between base and collector, but it also has a tuned collector coil which helps a lot, and a large capacitor to ground from base. This is a great help in maintaining the proper phase between the collector and the base, which is at times very important. The base should not be left floating, phase-wise, in many types of circuits. Always check this out. The oscillator is sure-fire for 8 MHz rocks. LI is tuned mainly by C2, with C3 matching into the base of Q3 the sextupler. Always do the larger part of your multiplication in the *first* stage, when you do have a choice, as with Fx6 and Fx3. This is because practically all active devices are less active the higher you go in frequency, so put the largest multiplier first, making L2 and C4 resonant on 48 MHz. Be sure it is on 48, not on 40 or 56! You will find that C2 and C3 match well into Q3. C4 tunes L2, and C6 is a good match into Q4. If the bottom half of L2 gives you trouble on 147 (spurious oscillations on 147) use the two-capacitor connections shown for the input of Q3. I didn't find much trouble here, so C5 did the job.

Tripler

Another HEP 55 still works well on 147, so the tripler Q4 is easy to work with and tune up. No plus voltage was needed on its base, there being sufficient drive from Q3 on 48 MHz. Also, of course, be sure it's on 147, or wherever your crystal multiplies up to in the two meter band. L3 and C6 tune to 147 with the antenna plate attached. To check for good output power, say 5 to 10 mW, couple into a tuned diode detector from L3 with a 1 to 12 pF capacitor into an output cable from a tap one turn up from the cold end of L3, plus a ground connection for the cable sheath.

Conclusion

You will find the crystal signal generator to be very useful for a lot of tests and the attenuator will allow you to make very interesting sensitivity and noise tests. When you back this unit down into that waveguide, you *cannot* pull in that signal! The attenuator is also very "repeatable" which makes calibration easy and important.

. . .KICLL

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PLL IC APPLICATIONS FOR HAMS

The single most exciting development of the mid-70's, at least as far as ham radio is concerned, will probably be remembered as the Phase Locked Loop (PLL). These remarkable circuits have applications galore. In fact the only real limit to their versatility is your own imagination and initiative. This article will outline several interesting applications with the emphasis on practical use rather than theory; where possible, exact component values will be given. For those desiring details as to the "why's" (heavy-theory), a bibliography follows the text.

General Considerations

The integrated circuits described are available in transistor-like packages, eight-fourteen-or sixteen pin dual-inline-packages and occasionally in sixteen pin flat paks. Their cost in single lots is generally less than $5 each. Cross-referencing or substitution of other than Signetics Corporation's IC's is usually not possible. The PLL, to my best information, is of a proprietary nature to the Signetics Corporation and not readily available from other sources.

The easily procured "Circuit-Zaps" allow rapid construction of a variety of circuits. A socket-type mounting arrangement is suggested for the IC to allow for its use in other circuits. For hams who have not worked with or used IC's before, a few precautions are in order: First, lead length should be kept as short and direct as possible. Second, do not neglect to use bypass capacitors to avoid unwanted instability and oscillation. Third, use only a small tip, low wattage iron for connections. Last, unused inputs should be grounded for best operation.

PLL Receiver

The NE561B integrated circuit together with a handful of inexpensive components produces a novel receiver usable from 1 Hz to 15 MHz. The frequency range provides for applications from the sub-broadcast band (e.g., WWV @ 60 kHz, marine and weather broadcasts) to the ham bands from 160–20 meters. If you can visualize a few components, an antenna band switch arrangement and audio-output stage, a truly miniature all-band WWB or CHU time receiver is possible, spanning the frequencies of 60 kHz through 10 MHz. On the more practical and realistic side, a simple receiver can be put together for about $10 for a particular ham band, a nice gift for that would-be-Novice you know. After all, who wouldn't rather hear live code than listen to tapes? Other

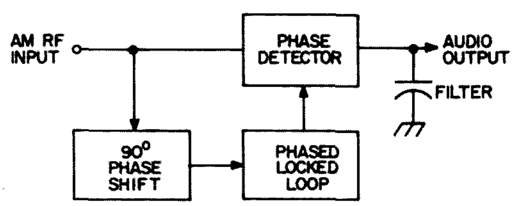


Fig. 1. Block diagram PLL AM receiver.

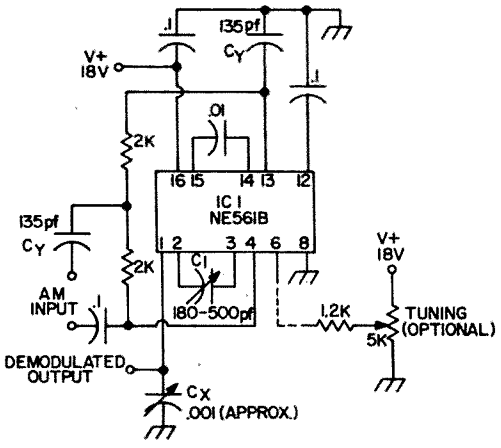
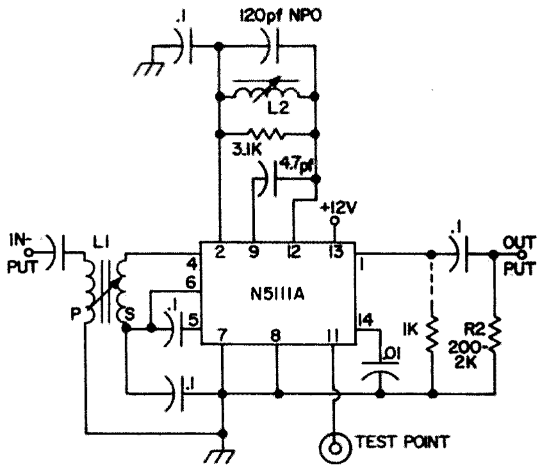


Fig. 2. Typical PLL AM receiver for the broadcast band. For other frequencies (1 Hz–15 MHz), Cy = (fhi – flo)/(fhi x flo). C1 = 300 pF/f(MHz).



L2 = 1.5–3uH MILLER 9050

Fig. 4. IC FM detector. 10.7 MHz output.

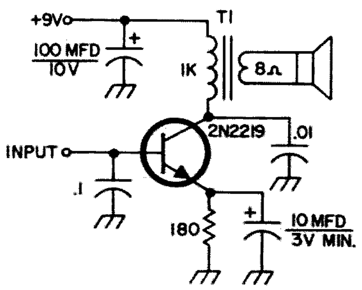
applications include tunable i-f strips for converters and FM demodulators without tuned circuits.

Figure 1 is the block diagram of the PLL receiver. The phase locked loop is locked to the signal carrier frequency and its voltage controlled oscillator (VCO) output is used to provide the local oscillator signal for the product detector, or for use as a synchronous demodulator. The PLL locks to the input signal with a 90° phase error. The strength of the output of the product detector is a function of the phase relationship of the incoming signal and the local oscillator's carrier(s). It is at maximum when the carrier and LO are either in phase or 180° out of phase and minimum when they are 90° out of phase or in quadrature.

Enough theory. Figure 2 describes a practical receiver. Components shown cover the standard broadcast band; however, the simple formulas shown on the schematic will enable you to calculate changes to allow operation from 1Hz to 15 MHz. Although the circuit is primarily designed for AM use, varying Cx will introduce sufficient change to allow CW/SSB reception. A tuned rf stage may be required together with a good antenna and ground. The voltage requirements can be met by connecting two 9V batteries in series. The PLL requires a maximum of 12 mA, with 10 mA being typical. The audio amplifier shown in Fig. 3 will be more than adequate for the PLL receiver.

FM Detector/i-f

While the N5111A shown in Fig. 4 is not a PLL, its relatively simple requirements as to discrete components and modest 12V power requirements will no doubt find their way into many receiver applications requiring a detector/i-f at 10.7 MHz. The input frequency range of the 5111 spans 5 kHz to



T1 = 1K:8Ω AUDIO TRANSFORMER

Fig. 3. Audio amplifier for use with PLL receiver.

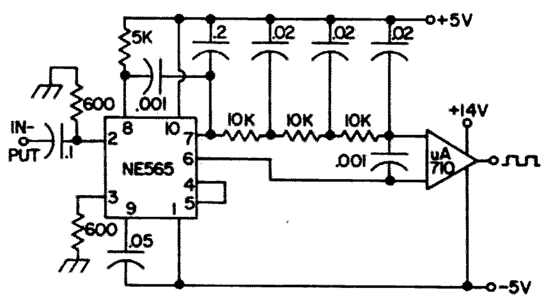


Fig. 5. Typical PLL FSK decoder (1070/1270 Hz).

50 MHz, making it a suitable detector/i-f for a number of converters, receivers, etc. Suitable applications for this IC include automatic control systems, receivers and servo amplifiers. There is no reason why a simple receiver cannot be built to monitor FM repeaters on the 10 meter band, or for the SWL a Lo-band monitor for commercial frequencies. Again, the applications are limited only by your imagination.

RTTY/FSK

Teletype and frequency shift keying is a natural application for the PLL. Figure 5 shows a two IC FSK decoder using the NE565 (PLL) and the UA710 differential voltage comparator. The dual voltage supply can probably be met with batteries as the NE565 will function with from 5 to 20 volts. The 565 is a general purpose PLL designed for applications at frequencies below 1 MHz. The circuit and component values are for decoding FSK signals of 1070/1270 Hz. As the FSK signal appears at the input, the loop locks to the input frequency, tracking it between the two frequencies with a corresponding shift (dc) at the output.

Single Burst Tone Generator

Again we are dealing with an IC which is not a true PLL. Instead, the NE566 is described as a function generator. The IC is a voltage-controlled oscillator exhibiting exceptional stability and linearity with buffered outputs of square and triangular waves. Frequency is determined by the external resistor R1 and capacitor C1 and the voltage applied to the control terminal (approximately .75 Vcc). Operation is possible with voltages from about 9–24V with typical current requirements of 7 mA. The value of R1 should be somewhere between 2K and 20 KΩ. Frequency adjustment over a 10 to 1 range is possible with the same capacitor. Typical applications include tone generators, frequency shift keyers, FM demodulators, clock generators and of course function generators.

The circuit shown in Fig. 6 is that of a single burst tone generator which produces a signal for a duration of one-half second (0.5 sec) after activiation of the power supply.

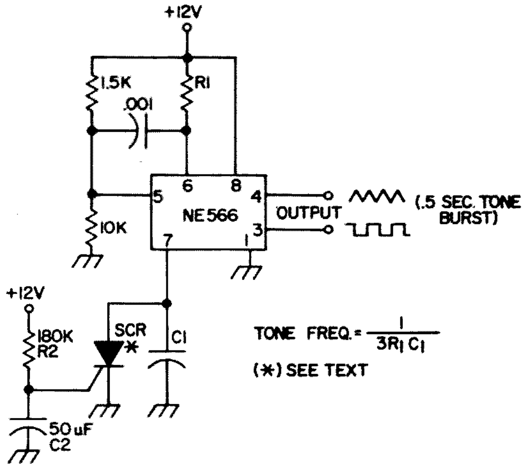


Fig. 6. Single burst tone generator.

The frequency of the tone is selected by the formula:

$$\text{Tone} = \frac{1}{3\ R1C1}$$

with the value of R1 being between 2K–20 KΩ. The SCR must be capable of triggering at a level of 70 μA as this is the maximum current available. Should you desire to increase the current, you can reduce the value of R2 while increasing the value of C2 to keep the same .5 sec. time constant.

This simple circuit can be readily adapted and built into existing FM transceivers as a subaudible tone generator to access repeaters. By varying R1 with C1 constant a "universal" tone burst generator can be built to enable the traveling ham to access any repeaters he might happen across on vacation, etc. In addition the modest 12V at 7 mA can be supplied by even a battery-portable transceiver with no trouble at all. The SCR can be replaced by a NPN transistor and the tone switched on and off at will at the base terminal of the transistor.

We have tried to present a number of useful applications for the PLL IC. These are but a few of the many uses to which they can be adapted in ham radio, and if nothing else this article is food for thought. Considering the modest cost and power requirements, shouldn't you invest about $10 and get some today?

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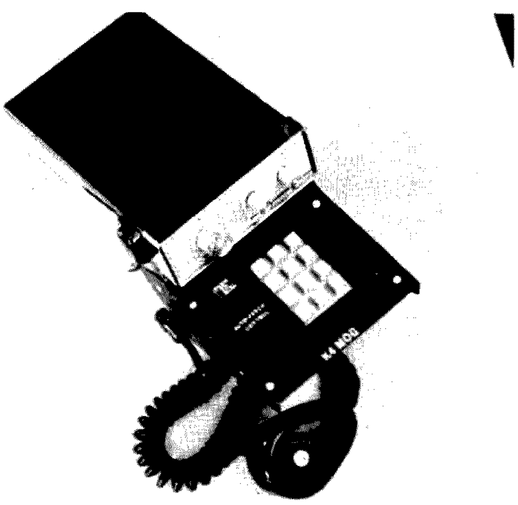
THE PATCH PAD

A circuit that allows auto-patch access and dial-up with one finger ease and convenience

Almost every major city in the United States has at least one 2 meter repeater that has auto-patch access capability. While the majority of telephone calls that go through these repeaters are generally of the social nature, there are cases where lives have been saved by the quick reporting of accidents by "Good Samaritan" hams with 2 meter auto patch capability. In Atlanta several months ago, when a million gallon fuel tank exploded setting several homes on fire and threatening others over a radius of a mile, the auto patch proved its value.



The "Patch Pad" shown assembled and attached to the transceiver.

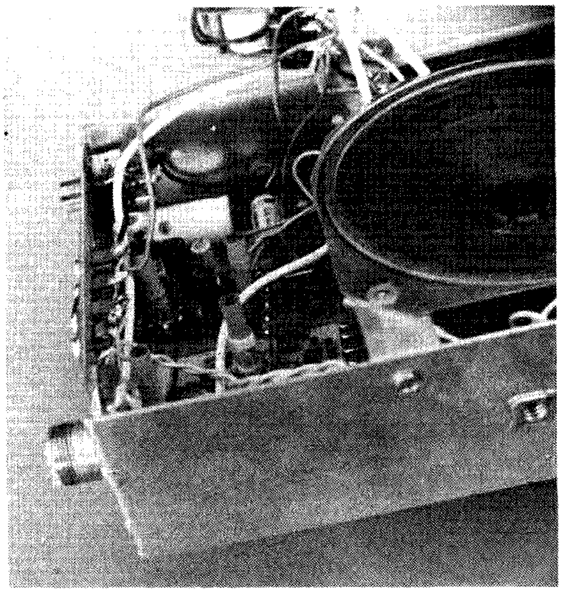
Members of the Atlanta Radio Club provided 80% of all emergency telephone communications out of the area through the club's auto-patch facility for 12 hours until the telephone company could run additional circuits to the operational command center. While the auto-patch system will never entirely replace the need for point-to-point communications networks during emergencies, it is fast becoming a standard tool in civil defense and related community service activities, and every amateur with 2 meter FM capability should have the ability to access the auto-patch in his area during an emergency.

Is It Hard to Add a Touch-Tone Pad to an Existing FM Transceiver?

There is no problem adding a touch-tone pad to any transceiver, as long as certain rules are followed. Ideally, when the pad is being used, the microphone should be

switched out of the circuit, even though the pad shunts the relatively high impedance of most crystal and dynamic microphones with a very low impedance. In most cases, this shunt is low enough to reduce the noise pickup from the microphone to a low level during the dial cycle.

However, in order to insure a pure noise free tone output it is a good idea to switch the transceiver input between the microphone and the pad during pad activation periods. In addition, it is important that the audio level out of the pad be set independently from the microphone level control. Most pads' output will be in the neighborhood of 3V peak to peak. If some provision is not made to control the output level of the pad, the microphone pre-amp will be overloaded and the tone input waveform to the modulator will be severely distorted. In some cases, the over-drive problem may cause the modulator circuit to over-deviate the transmitter out of the pass band of the repeater receiver. To overcome these problems, a separate audio level control is mandatory. Unfortunately, the addition of a level control can lead to an additional problem with frequency stability. If the low output impedance of the pad is not properly matched to the output circuit, comprised of a potentiometer and a dc blocking capacitor, minor frequency shifts can occur in the



Switched B+ is brought directly off of the change-over relay contacts and brought to an external tie point on the transceiver.

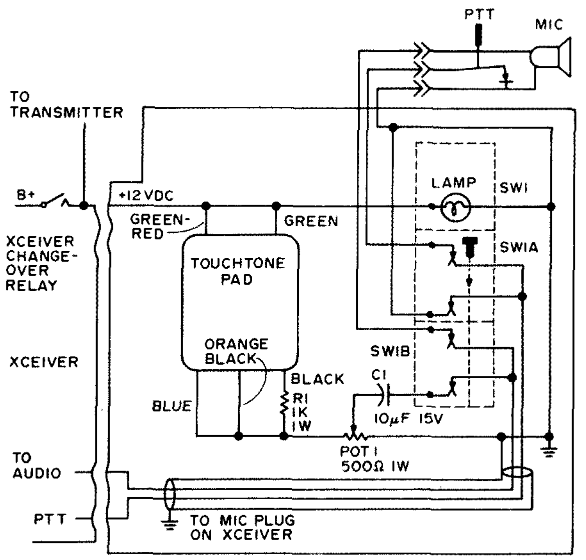


Fig. 1. Diagram of the 'optimized' TT pad schematic.

output frequency. Depending on the severity of the mis-match, under worse case conditions, the tone generator's output frequency can be pulled out of the pass band of the telephone company's switching equipment.

Therefore, it is most important that impedance relationships be kept within tolerance in any design using a touch-tone pad. Also, some provision must be made to control the amount of time required for the output to stabilize at the proper frequency and pre-set amplitude level. This period can range from a few milliseconds to several hundred, depending on the pre-set level of the internal bias that is controlled by external circuitry.

The final consideration in designing associated circuitry associated with a touch pad system is related to user ease. The design should be primarily optimized for operator convenience. One finger operation during the entire dial sequence is highly desirable. In addition, it is nice to know if and when the pad has been accidentally activated, possibly to the extent of turning on the transmitter. (This has happened during mobile operation more than once to even the best operators.) This problem can be avoided with the addition of a visual indicator such as a pilot light, during the time that the pad is activated. In short, the more care that is taken in designing associated pad circuitry, the better the results and the fewer misdialed numbers that will occur.

The 'Patch Pad' design meets most of these requirements and the associated circuitry can be built in one or two evenings depending on the physical design of the housing for the switch and touch-tone pad.

Construction of the "Patch Pad"

There are several makes of touch-tone pad configurations and they may differ between manufacturers. However, most of the color coding is standardized to the extent that the color combinations shown in Fig. 1 should be accurate regardless of manufacturer. Therefore, the internal circuitry of various pads is unimportant for the scope of this project. The same holds true for the transceiver modifications.

The only important consideration to remember when tying to the transmitter B+ is that it is 12V dc and negative ground. Most of the small solid state transceivers meet this specification. Those who use tubes in the final amplifier usually have a solid state driver stage that is fed from the switched 12V dc line, and tying into this switched source is no real problem.

Circuit Description

The circuit shown in Fig. 1 is generally self-explanatory, except for the operation of the circuit. SW1 is a "lock-on" type switch (Arrow-Hart 83504) with a pilot light assembly (83-500-70) and two contact blocks (83-500-30) that form in effect a pair of double pole double throw switches.

When the switch lens assembly is depressed, it locks into the down position. This actuates a plunger that causes SW1 A. to short the push-to-talk line to ground. This turns on the transmitter, which applies 12V dc, through the change-over relay to the transmitter board and simultaneously to the touch-tone pad and pilot light assembly in the switch. This voltage supplies the pad operating voltage and the pilot light in the switch alerts the user that the transmitter is on.

The plunger also activates SW1 B. This action transfers the audio input of the transceiver from the microphone to the pad, direct, assuring no extraneous noise will be mixed with the tones.

Potentiometer, Pot. 1 determines the

Quick disconnect of the "patch Pad" can be accomplished in a few minutes if mated plugs and tie strip connections are used.

level of the audio out of the pad, and Capacitor C1 blocks the dc voltage across Pot. 1, from the input of the transceiver.

The 1K resistor, R1, serves as an external bias control element. This value was found to be adequate to insure that the tones will rise to the proper frequency and amplitude within several milliseconds.

Installation

After wiring the components as shown in Fig. 1., locate a source of switched +12V dc when the transceiver is in the transmit position. In the HR2 series transceiver, this voltage can be taken directly from the transmitter section of the change-over relay. This should be the case with most other solid state transceivers. If possible, bring this voltage out through a tie point on the transceiver for quick disconnect convenience. Again, in the case of the HR2, one of the spare lugs on the rear can be used for this purpose, allowing the pad assembly to be quickly removed during crystal adjustments or final tuning procedures.

Once the switched 12V B+ has been located and the tie point in the transceiver wired, attention can be turned to the audio portion of the circuit. A female microphone jack that mates with the male microphone plug should be mounted on the touch-tone case in some convenient location. The audio and push-to-talk pins are wired as shown in Fig. 1. The output circuit is wired according to Fig. 1, paying attention to the fact that the microphone and push-to-talk circuits are wired to a male plug identical to the microphone plug. Other than the fact that the output plug wouldn't fit the transceiver microphone jack if this were not the case, there are other reasons for this arrangement.

Should some problem arise in the switching circuitry in the tone pad cabinet, the transceiver is not completely disabled. All that is necessary to bypass the problem is to unplug the microphone from the pad. Then unplug the pad output plug from the transceiver and plug the microphone directly into the transceiver, thus bypassing the pad and pad circuit related problems. In addition, if the matching plug scheme is adhered to, the pad can be completely removed from the transceiver in a matter of a few minutes if it is necessary, all without going into the transceiver each time to unsolder connections.

Setup Procedure

Before the pad circuit can be used on the air, the output level must be adjusted to a level not to exceed that of the microphone that is used with the transceiver. Otherwise, distortion of the sine wave will result when the microphone pre-amp is overdriven in the transceiver by the pad circuit. Plug the microphone into its mated plug on the pad assembly. Connect an oscilloscope to the pad output and whistle into the microphone with SW1 in the up position (Pad Off.) Note the peak value of the resulting output. Depress SW1 and then hold any digit on the keyboard. Note the level of the pad output. If the pad output is much higher or lower than the microphone output, adjust Pot. 1 until the pad's output is the same as the output of the microphone during the "whistle test."

After this checkout procedure has been accomplished, you are ready to go. All that remains is to find out the rules for the use of the local auto-patch circuit. Now you are ready to join the ranks of those hams who already enjoy the convenience of the world at their fingertips.

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Acknowledgement

I especially want to thank Jack Berry W4PME for his help in supplying me with data on the optimization of circuitry for the touch-tone pad.

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S-METER FOR AN HW-7

A simple modification that is a welcomed addition to the popular Heath QRP rig.

After assembling an HW-7 and finding the Heath rig quite nice, I wondered about an S-meter. To add one, remove the only screw holding the front panel to the back-up plate and increase the hole size. A miniature 1 pole switch (SPDT) can be inserted easily, and that takes care of the main mechanical work. The diagram shows a simple meter amplifier and rectifier. It was soldered together on a terminal board. Although it is comparatively frequency independent, this system uses the audio-beat as a signal so the volume control must be set in a fixed position. We took the audio directly from the IC output terminal into the circuit's input.

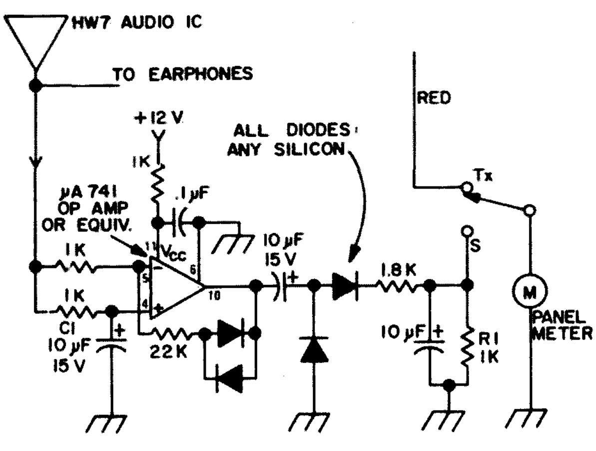

Fig. 1. Schematic of the HW-7 S-meter. R_1 should be determined by the operator's usual gain setting and a "loud station." It can vary between 680Ω and 4.7K.

The audio signal for the IC is fed to both input terminals via the 1K resistors. C_1 eliminates audio for the non-inverting input, but allows the dc bias to reach this input. The same bias voltage will arrive at the inverting input. Due to the common mode rejection of the amplifier, any dc bias on the input side will be ignored. The differential ac voltage, (audio signal) however, will appear across the inputs. The IC will amplify the signal in a non-linear manner, thanks to the feedback circuit and the back-to-back diodes. From there it is only a matter of rectifying the amplified audio, filtering it and using the derived dc to drive the meter. The switch is used to choose between S-meter and output-meter operation.

DJ0DQ

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Reprinted from the AMSAT Newsletter
Vol. V

INVERTED DOPPLER ?

Interesting things are happening with OSCAR 6.

The flight of OSCAR 6 has been a tremendous success; it has challenged the imagination and ingenuity of countless individuals by presenting the opportunity to devise and test new modes and methods of VHF communications, simple yet extremely reliable telemetry systems, accurate ranging systems utilizing commonly available equipment, new methods and findings in the area of propagation research, as well as countless other benefits.

It is this last subject, propagation, which we will address in some depth, concerning a UHF propagation anomaly first discovered while observing the 435.1 MHz telemetry beacon aboard OSCAR 6. For lack of a more descriptive term, we have chosen to christen the anomaly *"Inverted Doppler."*

Under normal circumstances, if one plots received frequency versus time for one satellite pass, a curve similar to the one depicted in Fig. 1 by the solid line will result. With only minor variations, this curve is representative of that which is predicted by the "Doppler Effect" theory. The apparent shift in frequency is due to the change in the satellite's velocity relative to the observer on Earth. Although many factors influence the *amount* of apparent frequency shift (such as tropospheric and ionospheric effects, variations in electron density and the plasma surrounding the satellite itself), all these combined effects will normally create a shift of only 40 Hz or so at a frequency of 400 MHz according to theory. Therefore, the effect may be practically stated in a slightly simplified form as follows:

As the satellite approaches the observer, its velocity is *added* to the velocity of propagation of the radio signal, creating an apparent *upward* frequency shift on the order of 8 kHz *above* the true (transmitted) frequency at 435 MHz. The amount of upward shift gradually but steadily decreases until the instant when the satellite is nearest the observer, or "TCA" (Time of Closest Approach). Its velocity relative to the observer is then zero, and at that instant the

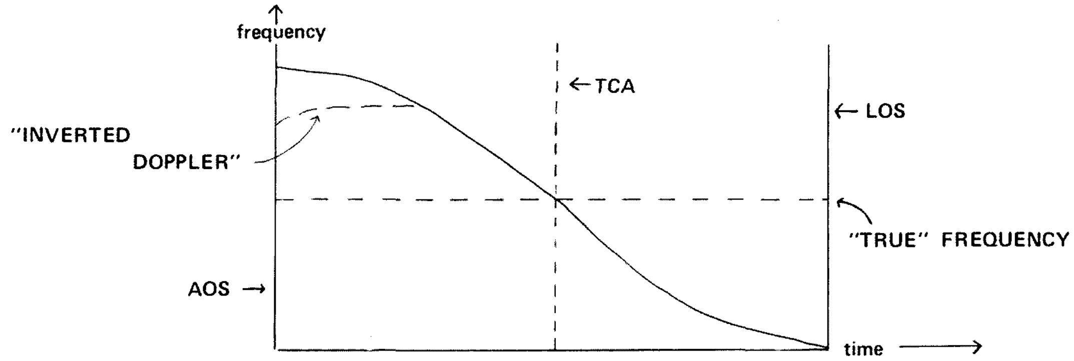

Fig. 1 A representation of the effect predicted by the Doppler theory.

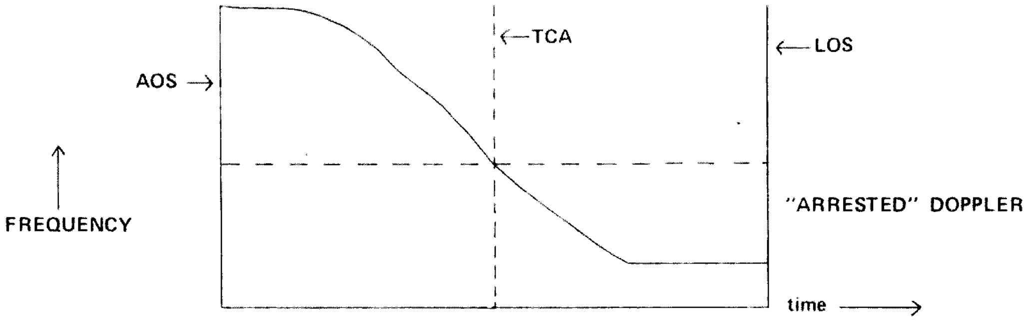

Fig. 2. The expected arrested Doppler effect.

observed frequency is the same as that transmitted from the satellite; i.e., no frequency shift, either up or down.

As the satellite *recedes* from the observer, its velocity is *subtracted* from the velocity of propagation, resulting in a total apparent *downward* frequency shift of approximately 8 kHz, for a shift during one orbital pass of ±8 kHz, or 16 kHz total.

This normal effect had been noted on all previous OSCAR satellites. However, on October 24, 1972, WØLER noted an unusual occurrence immediately following AOS (acquisition of signal) on Orbit 118. Instead of the normal downward frequency shift, the signal was *climbing* in frequency at a rapid rate. The climbing effect was gradually decreased, stopped, and then was followed by normal Doppler shift for the duration of the pass. Since no one else in the Minneapolis area was tracking the 435 MHz beacon at that time, WØLER was unable to verify the observation and assumed the strange behavior to be caused by drift in his receiving system. A thorough equipment check revealed no malfunctioning components, however. Subsequent orbits occurring later that evening exhibited only normal Doppler characteristics.

The following evening, the same upward shift was noted! This time, both the *amount* of upward shift, as well as the *duration* of the effect were measured and recorded as being approximately +450 Hz and 7 minutes following AOS.

At this juncture, WØLER contacted WØMJF, who had been observing signals on the 146/29 MHz translator aboard OSCAR 6. After discussing the anomaly at length, WØMJS proceeded to perform modifications to his receiving equipment which would allow reception of the 435 MHz beacon.

With two tracking stations now in operation, the rate of data collection was greatly increased, and with the stations on a north-south line only 25 miles apart, it was readily verified that both stations observed exactly the same phenomena.

After approximately three weeks of tracking and data analysis, it became evident that the Inverted Doppler anomaly was roughly confined to an equatorial crossing between 60°W and 90°W longitude. Due to the painfully slow eastward precession of the orbits, it was not possible to closely define the exact boundaries of the effect at this time.

Further analysis revealed that the duration of the effect was related to equatorial crossing time and showed an average duration of approximately 7.5 minutes past equatorial crossing on the *northbound nighttime* passes of OSCAR 6.

Our attention was then turned to the *southbound daytime* orbits passing over the same area in which the effect had been noted on the northbound passes. We anticipated that we would see an "Arrested Doppler" effect on the southbound passes; i.e., we expected the Doppler curve would be perfectly normal from AOS through TCA, but as the satellite approached the equator and LOS (Loss of Signal), we had reasoned that the normal *downward* shift, algebraically combined with the anomalous *upward* shift would probably cause the *observed* shift to be zero; i.e., the normal downward shift would appear to be "arrested" (see Fig. 2).

Extensive investigation proved fruitless. Absolutely no abnormal effect was observed on the southbound daytime passes, even though they crossed exactly the same area as the nighttime passes had.

Continued investigation of the nighttime passes resulted in further refinement of the available data. The effect was found to encompass an area between 50°W and 105°W longitude as observed from our location in Minneapolis (45°N, 93°W). The magnitude of the upward shift varied from 20 Hz to 550 Hz, with the greatest majority of measurements falling in the range of 200–500 Hz. Duration of the effect past equatorial crossing averaged 7.43 minutes, with 91% of the readings falling within the range of 6–9 minutes.

Due to operational procedures designed to conserve battery power, OSCAR's 435 MHz beacon was not run continuously, leaving several gaps in our data. We then turned to reception of signals from the NOAA-2 Weather Satellite operating on 137.5 MHz in order to speed up data collection. (NOAA-2 was launched by the same vehicle which carried OSCAR 6; therefore, both satellites were in an essentially identical orbit.)

Results were negative on 137.5 MHz. Several concurrent tests were conducted by tracking OSCAR 6 on 435 MHz and NOAA-2 on 137.5 MHz. Even though the two satellites were only 20 minutes apart, with practically identical equatorial crossings, no Inverted Doppler was noted on NOAA-2's signal, even when it had been observed only 20 minutes earlier on 435 MHz.

These new findings led to the suspicison that the upward frequency shift might be caused by oscillator drift in the OSCAR transmitter, probably resulting from thermal effects associated with the satellite's passing from sunlight into the Earth's shadow.

Two other stations who had been tracking the 435 MHz beacon were then contacted; Ted Mathewson W4FJ, Richmond VA, and Dick Allen W5SXD, Houston TX . Neither station was able to detect the anomaly that was being observed at our more northerly location. One possible explanation is that the anomalous effect may occur near TCA for these stations, at which point it would be most difficult to detect.

When the 435 MHz beacon's output power dropped drastically on orbit 1081 (1/10/1973), we immediately built equipment for the 400 MHz satellite band. After a week of construction and testing, we commenced tracking operations on 400 MHz. We soon discovered that most of the satellites in that band are only turned on for short periods in order to retrieve stored data and then immediately shut down, yielding no data useful for our purposes.

Finally, after many fruitless hours involved in tuning, tracking, calculating of orbits, etc., we experienced success on January 30, 1973. Inverted Doppler was observed on a satellite named Copernicus, operating on approximately 400.562 MHz. Spurred on by this new evidence, and assisted by many other amateurs who suggested possible frequencies, satellites, and orbital parameters, we finally located a group of five satellites which were in continuous operation and in a near circular orbit inclined only ±2° off the poles. These satellites are a part of the Navy's "NavSat" (Navigational Satellite) System, transmitting on 149.988 and 399.968 MHz simultaneously, by multiplying a common frequency source at 49.996 MHz times 3 and 8. One important difference between these satellites and OSCAR 6 is their orbits' relation to solar time. At the time we commenced tracking the NavSats, their northbound pass occurred in the *daytime*; southbound at *night*; exactly the opposite of OSCAR 6!

The "Arrested Doppler" was indeed observed on the *southbound nighttime* passes, occurring almost exactly as predicted earlier! The normal downward shift merely tapers off and ceases, followed by several minutes of absolutely stable, steady signal until LOS! Absoluately no abnormal behavior was observed on *northbound daytime* passes.

Now came the task of refining our measurements of the orbital period of the five satellites. Accurate calculations concerning the time of equatorial crossing also had to be generated from sequential TCA observations.

Finally, all the necessary data was collected and a new set of computer listings containing orbital predictions was rapidly prepared by Hank (WØRLI) Oredson. As the fates would have it, the effect ceased abruptly on the next day, February 5, 1973!

As of May 5, 1973, the effect has not been observed again at this location.

Since that time, we have continued the research by reviewing any material even remotely associated with possible causes of the Inverted Doppler effect. One very promising item which recently came to light is contained in Part 2 of an article by Dr. Roger Harrison VK2ZTB of the Ionospheric Prediction Services Division of the Commonwealth Bureau of Meteorology in Darlinghurst, Australia. The article was printed in the February 1973 issue of the *VHF Communicator*, and is entitled "VHF Trans-Equatorial Propagation."

There appears to be several possible correlations between the Inverted Doppler effect and an effect mentioned by Dr. Harrison, called "Evening," or "Class II" TEP (TransEquatorial Propagation). In the article Dr. Harrison mentions that Class II TEP "shows a maximum occurrence between 2000 and 2300 LMT (Local Mean Time) with a pronounced peak for different seasons and particular paths." (OSCAR 6's northbound equatorial crossings occurred at approximately 2049 LMT.) He further states that maximum Class II TEP occurs during December and January from North and South America. The magnitude of the Doppler shift observed in connection with Class II TEP is definitely in the right ballpark. Further, VK2ZTB says that "Class II TEP is dependent on many factors (season, sunspots, geomagnetic latitude, etc.) that seem to have no bearing on true scatter mode propagation." He also offers the possibility that "Class II TEP is probably supported in some way by field guided ionization; *the closer a ray can be launched to tangency with the magnetic field, the more favorable are its characteristics; i.e., higher frequencies will be supported.*" This last statement may well hold valuable clues concerning the Inverted Doppler anomaly!

At this point it would seem beneficial to summarize some of the findings concerning the anomaly:

1. Inverted Doppler is apparently a night-time effect.
2. Inverted Doppler is apparently a seasonal effect, perhaps centered on the Winter Solstice.
3. Inverted Doppler seems to be frequency selective, since its effect was never observed at 137.5 MHz.
4. Inverted Doppler effect apparently ceases when the satellite reaches the vicinity of 23.24°N latitude (average) computed from the satellite's velocity and the average duration of the effect. (The Tropic of Cancer is located at 23.5°N latitude.)
5. The apparent eastern boundary (from Minneapolis) at 50°W longitude is explained by the fact that orbits crossing the equator further east than this point would have been more than 7.5 minutes north of the equator before we acquired the signal. This explanation does not, however, satisfy the western cutoff at 105°W, since we should still receive some part of the first 7.5 minutes past equatorial crossing out to approximately 123°W.
6. There may be a possible correlation between *maximum* shift magnitude and *minimum* "A-Index" as shown in Solar Geophysical Reports. More data is necessary to confirm this theory.

Our investigation continues, utilizing data gathered by research satellites such as ARIEL I (NASA SP-119), giving us profiles of electron, ion, and magnetic effects in the area of interest. No conclusions have been reached; however, theories abound. We welcome any offer of assistance in the effort, since several questions still must be answered:

Do observers further east or west, but located near 45°N latitude observe the effect?

How far south is the effect detectable?

On what dates does the effect commence and terminate?

Is it somehow related to Class II TEP, and are *both* effects related to the "A-Index" and Solar conditions?

Could VHF/UHF communications via this mode be possible over vast distances?

The list of questions is endless. We solicit reports from any stations which were involved in tracking the 435 MHz beacon on OSCAR 6, be they positive or negative. All reports will assist in pinning down the area of the effect, and will be most welcome.

. . . WØMJS & WØLER

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THE L'EGGS INJECTOR ANTENNA

The need for a very rugged self-supporting vertical antenna that could survive the rigors of ice storms and other winter excesses was recently required by W1SNN.

Research applied to radiators available from area vendors revealed a large complement of antennas, many of which were well constructed but not suitable for winter due to the excess appendages required for matching.

References were appraised which led to the following: A vertical antenna which offers thé smallest possible profile, and therefore low wind loading, is best in ice storms. Antennas using radials and external tuning apparatus are to be regarded as potential ice collectors.

The insulators used must offer a large smooth area, preferably round or egg shaped. This feature reduces ice packing, provides a good run-off for rain and precludes collection of dirt particles.

An impedance transformer to insure a very close match to the load value of the radiator should be a part of the antenna.

A look at antennas used in the commercial, land mobile and public safety services revealed a hard look had been already taken in the areas described . . . many conclusions led to a skirted antenna. This antenna is not new to amateurs, but in the past has not been popular because of its very narrow band response and its construction problems.

The coaxial skirted antenna acts like a half wave antenna in free space by using a skirt to form the bottom half of the dipole. The skirt also serves another purpose; it acts as a choke which isolates the antenna from its supporting metal mast.

The formation of the skirt does not change the current distribution on the upper half of the dipole. The inside of the skirt becomes a short circuited quarter wave line forming a high impedance at the base of the skirt. If we move along the outer conductor to the next quarter wave point, below the first skirt, we could install a second skirt or

for that matter a series of them could be added at each quarter wave section. This antenna would become a coaxial collinear array. Of course, some additional gain would be recognized, but now we deviate from simplicity of construction for a small gain improvement.

The large diameter to length ratio of the skirt produces an end effect which requires the exterior length of the skirt to be reduced; however, the interior length is increased to its proper electrical one quarter wave length by a dielectric slug. The slug now serves as a skirt insulator and insures concentricity. Also, a small length of tubing telescoped within the skirt can be added to adjust the antenna to exact length.

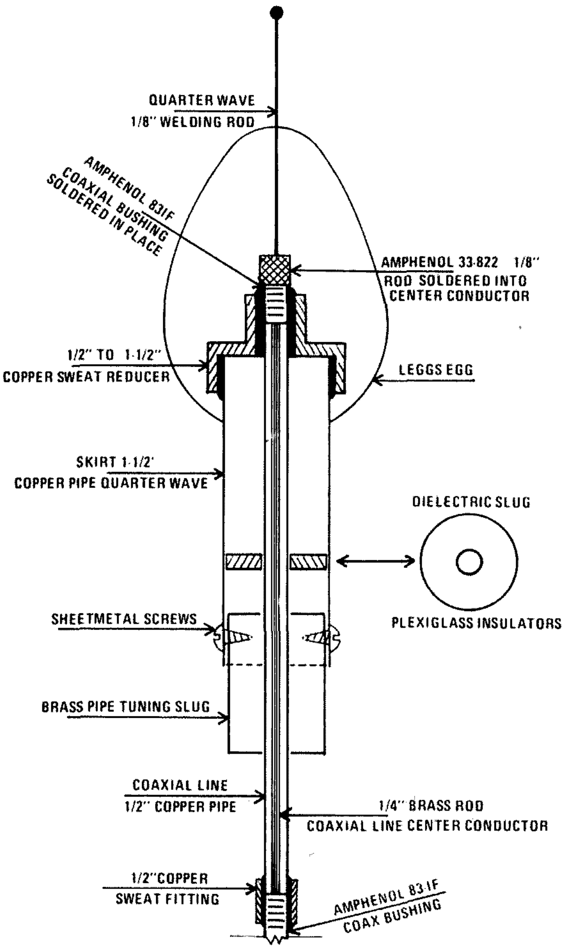

Fig. 1. Cross section view of the construction details for the Leggs Injector Antenna.

PARTS LIST

1 — 36" length of ½ in. water pipe
1 — 36" length ¼ in. diameter brass rod
1 — 17" length 1½ in. copper water pipe
1 — ½ in. to 1½ in. reducer copper sweat fitting
1 — ½ in. sweat coupling
2 — UG363 - 1U bulkhead bushing Amperol #83-1-F
1 — Jan 49190 teflon loaded Amphenal #33-822
1 — 1½ in. "P" trap extender pipe (brass)
4 — #6 sheet metal screws
1 — Leggs (panty hose container)
1 — 4" square ½ in. thick plexiglass
1 — 1/8 in. brass brazing rod 36"

A section of self-supporting coax is a part of the antenna which serves a twofold purpose. It provides a transmission line for the antenna proper and is the mechanical support for the entire radiating system. It is easily constructed from copper water pipe.

There are two important dimensions; the inside diameter of the outer conductor and the outside diameter of the inner conductor are calculated from the equation as follows:

$$Z_O = 276 \log \frac{b}{a}$$

Where: Z_O = characteristic impedance
b = center to center distance between conductors
a = radius of conductor (in the same units as b)

The calculation reveals ½ in. water pipe with a center conductor of ¼ in. diameter has the correct ratio of diameter required for a 50Ω coaxial line.

Refer to the table for components needed to construct 59 or 70Ω antennas for four popular frequencies used for repeaters and general FM work.

Dipole and Skirt Dimensions

	Skirt Length	Skirt Diam.	Dipole Length	Dipole Diam.
50 MHz	50"	1½"	52"	1/4"
146 MHz	17"	1½"	18.1"	1/8"
220 MHz	10.5"	1¼"	11"	1/8"
440 MHz	5"	1"	6"	1/8"

Coaxial Line Dimensions

	50Ω	75Ω
Outer conductor	½"	½"
Inner conductor	¼"	3/32"

A graph describing the bandwidth plot showing the VSWR range of a two meter antenna is included (Fig. 2) to give some idea of the useful bandwidth of this antenna.

To construct a two meter version, start the assembly by inserting the ½ in. water

pipe into the ½ in. to 1½ in. reducer, half way through the small opening. Mount a coaxial feed-through bushing just above the water pipe as shown in the cross section drawing . . . very carefully solder both pieces into place. Next cut a piece of ¼ in. brass rod to a length of 35 in. and file each end back ½ in. to be 3/16 in. in diameter so that it will slide into a coaxial bushing with a firm grip. Insert one end into a coaxial bushing; then slide the other end into the ½ in. water pipe and into the previously soldered coaxial bushing. Then solder the second bushing into the previously soldered coaxial bushing. Solder a ½ in. sweat coupling to the opposite end of the ½ in. water pipe; place the second coaxial bushing into this sweat fitting engaging at the same time the remaining end of the coax center conductor; sweat solder this bushing into place.

Next slide a 1.7 in. length of 1½ in. diameter copper pipe over the ½ in. pipe into the reducer and solder to the reducer socket. Make sure the two pipes are concentric.

With a scribing divider mark two dielectric slugs on the 4 in. piece of ¼ in. thick plexiglass; cut them out with a coping saw and sand the edges smooth. Slide both pieces over the end of the ½ in. pipe up into the 1½ in. pipe used as a skirt, push them up 4 in. Slide a piece of trap extruder brass tubing into the end of the skirt. This tubing has a very thin wall and will slide into the skirt firmly.

Cut a piece of brass brazing rod to a length of 18.4 in, Solder the opposite end of the 1/8 diameter rod into an Amphenol

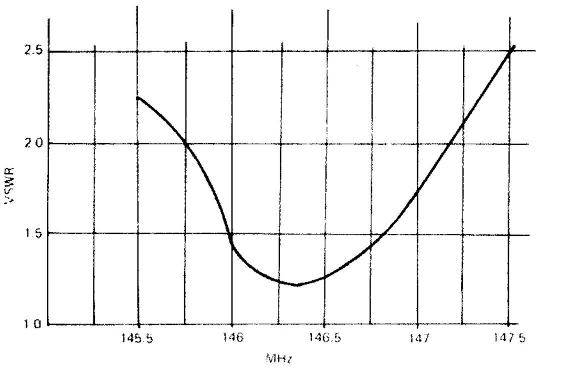

Fig. 2. Graph showing VSWR versus frequency for the antenna.

33-822 teflon loaded connector, push the rod down into the male pin and make sure the solder sweats to the whole pin and rod connection. Insert the connector into the coaxial bushing which is at the junction of the skirt and the coaxial line.

Now for the XYL pleasing touch! Go to the nearest L'eggs Boutique® and pick up a pair of panty hose (L'eggs)... be sure you get the right color and be darned sure of the size if you want to continue your career in ham radio! This product comes in a white plastic egg-shaped container. Remove the product and give them to the XYL... but keep the egg.

Cut a 1½ in. hole around the center of the large end of the eggshell and slip it over the skirt. Slide it up so it butts against the ½ to 1½ in. reducer rim. Punch a 1/8 hole into the opposite end of the egg and slide this section over the 1/8 dipole rod. Now mate the two halves of the L'eggs egg and you have a cool insulator which will stand all of the ice problems as well as dirt. A touch of epoxy cement at the rod entry and some more at the egg joint and you have completed an antenna which is as tough as any available.

Next feed in some rf through your favorite VSWR indicator, adjust the brass telescope section of the skirt for the lowest VSWR. Secure the brass section with three sheet metal screws or solder it so it won't move.

Now all that is left to do is to securely mount the antenna to your mast. Stainless steel or galvanized dip hardware should be used. I found a pair of Sears #13K19842 fence hinge supports provided an excellent mount. Simply push the ½ in. coax section through the pintle openings and space them six inches apart. The clamp ends fasten to a mast and they are then drawn up tight with a galvanized bolt and nut supplied for this purpose.

This small antenna looks like a converted hypodermic injector and gets its name from that appearance. It has withstood winds up to 65 mph so far, and several ice storms which would have demolished a lesser antenna.

...W1SNN

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A TWO METER CONVERTER

For the amateur beginning serious work on VHF.

This article describes a "second generation" FET converter using an IGFET rf amplifier. The MFE 3007 can provide superior noise figure and cross modulation characteristics with very low cost in amateur applications. The performance characteristics are not particularly needed or sought at two meters because the ambient ignition and powerline noise in this area always masks any receiver noise, but the cross modulation characteristics are desirable for in-band duplex and for checking the purity of strong signals without having the receiver generate more spurious signals than the transmitter. Lastly, and most serendipitious, is the fact that the extremely low internal feedback capacitance of the MFE 3007 almost eliminates the instability and oscillation problems that befell JFET and bipolar transistor amplifiers. This makes this converter an excellent first project for the VHF builder starting serious work with receivers.

The Circuit

The circuit of Fig. 1 starts with the popular overtone crystal oscillator circuit using a 2N5182. Almost any VHF silicon transistor will work in this circuit, but the 2N5182 works quite well, and the price is pleasant. The crystal is a 43.333 MHz overtone cut. The oscillator tank coil, L8, is coupled with a 9 pF capacitor to the base of a class A tripler, another 2N5182. The 130 MHz signal from the tripler tank coil, L9, is injected into the gate of the mixer through the 5 pF capacitor. The input frequency of the mixer, 144 MHz, minus the 130 MHz injection frequency, gives a 14 MHz output frequency that can be used with amateur band or general coverage receivers. Other local oscillator and output i-f frequencies can be used, of course. The rf amplifier employs a single MFE 3007 in the common source configuration. No neutralizing is used. One gate is used for bias and the other is used for the signal input. Three tuned circuits are used in the input to provide added selectivity against images from other VHF services. The output from the rf amplifier is inductively coupled to the mixer by L4.

Construction and Alignment

As with most projects, the converter should be built and tested a stage at a time, starting with the oscillator. The pictures show an earlier version with two stages of rf amplification, the first of which was simply removed and replaced with L1 and L2. The base material is double clad printed circuit that is quite light, strong, and easy to work with. The shielding used is quite minimal, and probably is unnecessary. Any layout with reasonably short leads and logical placement can be used. The components are merely soldered to each other, or whatever is handy, insuring minimal stray coupling. Each variable capacitor used with L1, L2, and L3 is a piston type trimmer, but other types can be used with the same capacitance range. This arrangement, however, provides a handy mechanical way to anchor the "hot" end of each coil. Other tuned circuits are slug tuned.

Construction and alignment should proceed quite simply, but the signal at L9 may be hard to get. When problems develop, just

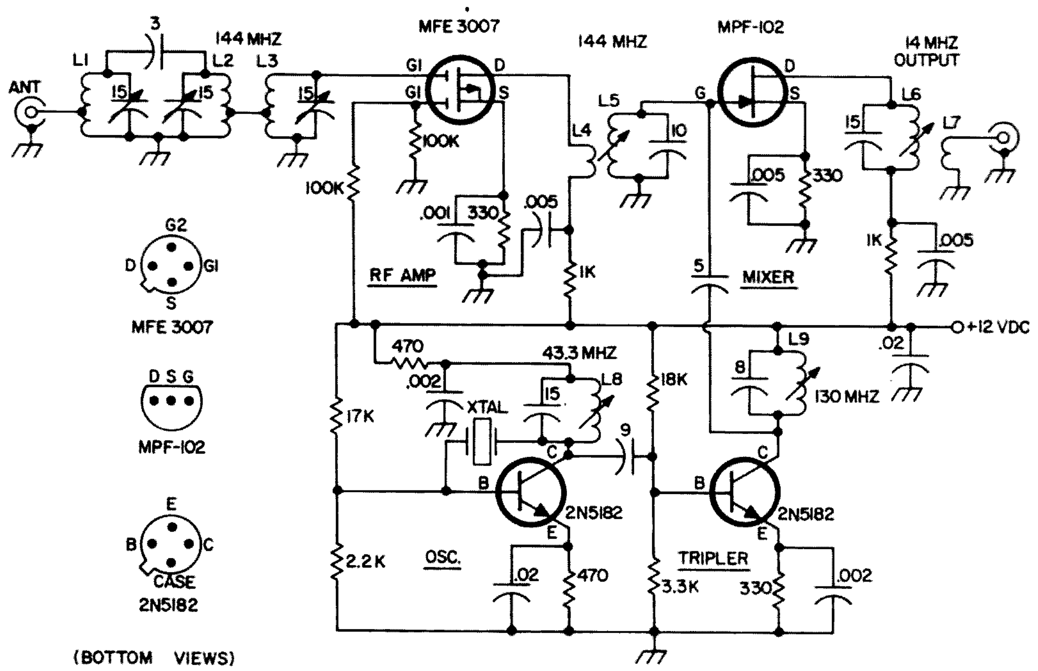
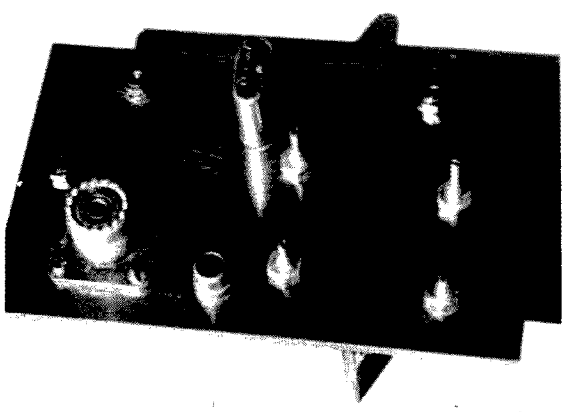
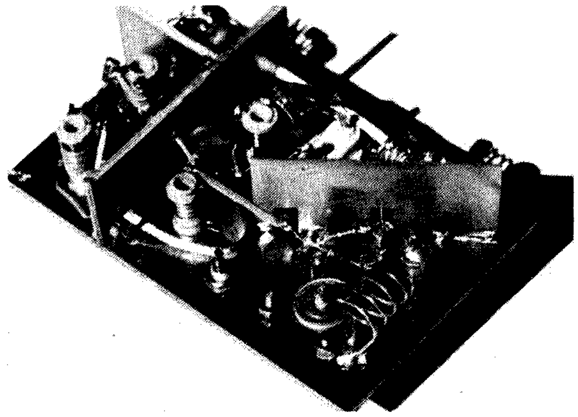


Fig. 1. Schematic of the 2m converter. L1, L2 and L3 – 5 turns No. 18, 0.7 cm diameter airwound, about 2 cm long, tap at one turn, adjust to resonate at 144 MHz. L4 – 3 turns hookup wire on L5. L5 – 3 turns No. 20, 0.7 cm diameter slug tuned, 1.3 cm long, resonate at 144 MHz. L6 – 30 turns No. 30, 0.7 cm diameter slug tuned, resonate at 14 MHz. L7 – 6 turns hookup wire on L6. L8 – 10 turns No. 24, 0.7 cm diameter slug tuned, resonate at 43 MHz. L9 – 4 turns No. 24, 0.7 cm diameter slug tuned, resonate at 130 MHz.

tune the grid dip meter to the proper frequency and set its pick up coil near the tuned circuit. Tune the circuit until a dip is observed on the meter in the oscillating mode. Then switch to the absorption wavemeter position, and the signal will be there. If a defective transistor is suspected, use a VOM in the RESISTANCE TIMES ONE position to check the two junctions in the two bipolar transistors. Higher voltages in some VOMs can destroy transistor junctions, resulting in all transistors tested being bad. I know of no similar simple test for FETs. If you know how the leads on bipolar transistors are arranged at the base, the 2N5182 may teach you that you don't. After the 130 MHz output from the tripler is obtained and peaked, small as it may be, and the other tuned circuits are dipped on frequency, final alignment can be done with a signal generator. Final tuning in most cases must usually be done with an antenna and remote signal. Most inexpensive signal generators have enough leakage that all of the signal will not go only through the input tuned circuits, and tuning them will only show a good peak on a remote signal that is coupled through the input connector. No trouble should be encountered in alignment, the rf stage only took a couple of hours to get working, and no oscillation or instability was detected. Some care should be taken when handling the MFE 3007, however. The transistors are sold with the leads clipped together with an



Double-sided copper-clad board is used for the chassis and shield sections. Definitely easier to work with than aluminum!



The coax connector serves for the 2 meter input and the phono jack for 14 MHz output. The slug tuned coils, clockwise from the crystal, are L8, L5, L6 and L9.

eyelet to prevent static charges from destroying the junction. The leads can be tied together with a short piece of small wire while handling and soldering. It also helps to ground yourself and all objects that will be used in the installation. The soldering iron or gun should be unplugged and grounded while soldering, there may be leakage between the hot side of the power line and the tip of soldering iron.

These general comments and procedures can be taken lightly for what they are worth to each individual reader. The purpose of most articles is to provide information and ideas that the reader may not have been exposed to, rather than specific and rigorous step by step instruction.

Conclusion

The converter has been quite successful in all cases with the only possible exception being damage to the MFE 3007. Some changes may be made to optimize the rf amplifier. The higher the gate bias voltage, the higher the gain and poorer the noise figure. The gate voltage could be lowered and the 1K drain return resistor could be made smaller or replaced by a choke to raise the drain voltage. However, the results have been good without further changes. Also, agc can be applied to the biased gate. Considering cost of the transistors, and ease of alignment, this was a better than average project.

. . .WB6BIH

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VERSATILE IC KEYER

An inexpensive and easy-to-build unit that features Relay and Solid State output.

This article describes a keyer circuit which utilizes IC's throughout. It is a compact unit, cheap to build, gives an accurate 1:3 dot-dash ratio at any keying speed and features self-completing characters. It could be easily battery powered if so desired.

The unit can be built for about $12 including the cabinet, transformer and IC's if the parts are purchased surplus.

Overall Circuit

Three DTL *nand* gates (TTL is also suitable) function as a variable frequency oscillator which produces a square wave. This signal is fed to a 'one-shot' for pulse shaping. The pulse signal serves as clock signal for the dot generator JK flip-flop.

The dot and dash generator consits of 2 JK flip-flops, 2 diodes and one *nand* gate. The diodes provide memory functions and the gate does the necessary gating to provide a high and low output. This high and low signal controls a transistor switch and a reed relay for transmitter keying.

The circuitry requires a regulated 5V dc at 60–80 mA.

A circuit for a monitor tone generator is also shown.

Circuit Function

Variable Oscillator

Nand gates 1, 2 and 3 function as a variable frequency oscillator. Capacitor C1 and resistors R1, R2 determine the oscillation frequency. With the values shown, 10 μF and 1270Ω, the oscillation frequency is

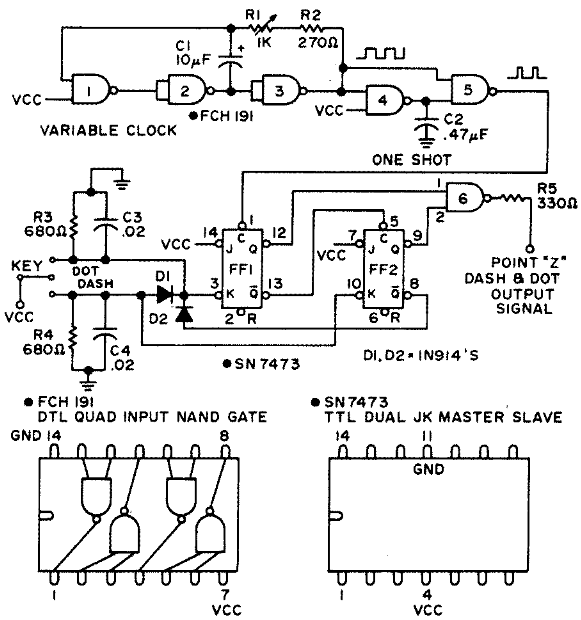


Fig. 1. Schematic.

adjustable from about 150 to 1500 Hz. This is equivalent to roughly 4 to 40 words of code speed per minute. Any value capacitor (0 pF to 1000 μF) can be used to obtain any ridiculous oscillation frequency as long as the total resistance of R1 and R2 do not exceed 1500Ω.

One input of gate 1 and gate 4 is tied directly to VCC (+5V) to minimize loading of the oscillator and to maintain a square wave.

'One-Shot'

Nand gates 4 and 5 serve as a 'one-shot.' The approximately square-wave signal of the oscillator is reshaped to a sharp-edged narrow pulse which is ideal for clocking the JK flip-flop. Capacitor C2 determines the pulse width of the output signal.

JK Flip-Flop Operation

Flip-flops 1 and 2 are SN7473 TTL JK masterslave flip-flops. Together with diodes D1 and D2, and *nand* gate 6 they provide the necessary circuitry for dot and dash generation. A fixed 1:3 dot to dash ratio results at any keying speed. The JK FF's function as follows: at the positive edge of a clock pulse the FF loads the J and K input information to its slave flip-flop. At the negative edge of the clock pulse it executes according to the JK flip-flop truthtable. As for our circuit, two high inputs (at J and K) cause the FF to toggle with every clock pulse. A high and a low input make the FF only toggle if the input status had changed from the last clock pulse.

Dot Generation

Unkeyed, the FF's have a steady high at Q1 and Q2. *Nand* gate 6 therefore gets two high inputs, causing its output to be low. If the keyer is moved to the dot position, input K1 goes high, Q1 goes low and $\bar{Q}1$ goes high at the first occurring clock pulse from our 'one-shot.' Thus, one input to gate 6 goes low causing the output of gate 6 to go high. When the second clock pulse occurs at FF1, there may be two input alternatives: K1 may be low if the key was released or may be high because the key is still held in the dot position. In either case FF1 will toggle, resetting Q1 high and therefore restoring the gate 6 input high again. Gate 6 output returns to low. At the third clock pulse, another character cycle may begin. If we look at FF2 during this operation, we see that $\bar{Q}1$ gave a clock pulse to FF2. But since there was no input status change at K2 during this time period, FF2 did not toggle.

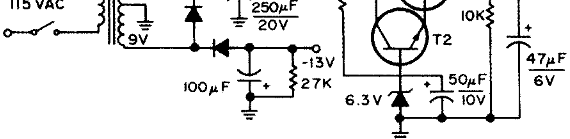


Fig. 2. Power supply. T1-2N1893, T2-2N2925.

As the key is moved to the dash position, K2 goes high, and, through diode D1, K1 goes high also. At the first occurring clock pulse to FF1, FF1 immediately gets busy with a dot generation, while FF2 can't do anything because it lacks a clock pulse at the time. As the second clock pulse occurs at FF1, FF1 toggles again and gives the desired negative clock pulse edge to FF2. Since FF2 loaded the input information 'high' at the positive slope of that clock pulse already, it executes a toggle, regardless if the key was released from the dash position in the meantime or not.

Thus, after FF1 provided the first third of a dash (a dot), FF2 toggles now and provides the second third of a dash by holding the other input of gate 6 low. During this operation $\bar{Q}2$ went high and supplies K1 with an artificial high through diode D2. As FF1 receives the third clock pulse it registers K1 high and goes through another dot generation cycle. This time, both Q1 and Q2 are low, and the output of gate 6 stays high again.

Now clock pulse 4 comes up at FF1 and causes FF1 to toggle either because the K1 input went low (an input status change) or because the operator pushed for another character already (both inputs high). As for FF2, it receives the negative edge of a clock pulse from FF1 $\bar{Q}1$. Again, FF2 will toggle regardless of whether K2 is low (input status change) or high (both inputs high). The Q

outputs of both FF's will therefore be high in this timing cycle and cause a low gate 6 output. Another character may begin at the fifth clock pulse to FF1.

Relay Driver or Output Switch

The output of gate 6 is not suitable for keying a transmitter as is. It must be amplified to operate a relay or to control a power transistor switch. Figures 1A and 1B show two alternative circuits. In Fig. 1A, transistor T1 switches a relay whenever the gate 6 output goes high. A fast relay such as a reed type must be used. This relay should not take its power from the VCC +5V for the logic circuit, but be supplied with about 12V dc from before the 5V regulator. In Fig. 1B, the circuit I built into my keyer uses two transistors, one low power NPN type and one 60V 500 mA PNP. When gate 6 output goes high, the collector voltage at T1 drops to 1.2V and changes the bias voltage to T2. T2 bias goes negative and the PNP

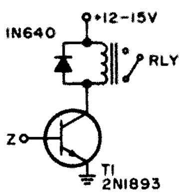


Fig. 3A. Relay driver.

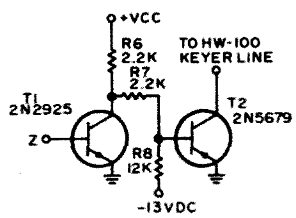


Fig. 3B. Solid-state switch/HW-100.

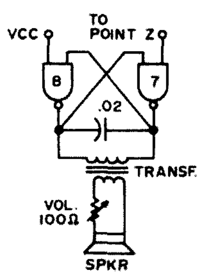


Fig. 3C. Tone monitor.

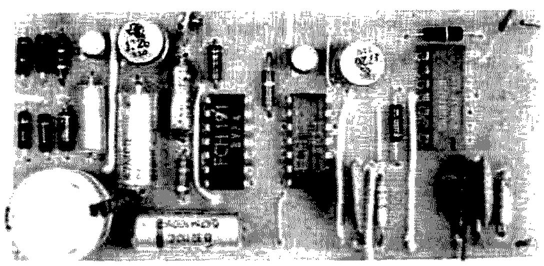
transistor conducts. Resistor R8 is critical in respect to the negative supply voltage and should be 1000Ω per volt. The collector of the PNP switches my HW-100 transceiver directly, and probably many other transmitters can be keyed this way, free of any relay clicks.

Tone Monitor

In this circuit, two of your *nand* gates remain unused. They can be wired to make a multivibrator tone generator (Fig. 1C). The oscillation of this tone oscillator is controlled by a 'high' or 'low' at the output of gate 6/ input of gate 7. A low power minispeaker with matching transformer or a 600Ω headphone capsule can be used as speaker device. The tone pitch can be lowered by adding a capacitor in parallel to the speaker inducuctance (.02 μF). If a 600Ω headphone capsule is used, no additional space is required on the circuit board. Otherwise a transformer would have to be accommodated somehow.

Summary

This unit was built onto my homebrew paddle mount and mounted in a 8 x 12 x 8 cm cabinet. The bottom was weighted with a steel plate.



I like the keyer because of its compactness and state of the art. The photograph shows the circuit board with the power supply on the right side (except transformer) and the other circuitry spread over the rest of the 10 x 5 cm board. The keyer works nicely and I enjoy CW more than before.

...VE3GSP

References:
73, March '67.
Radio Amateur's Handbook.

Warren MacDowell W2AOO
11080 Transit Road
East Amherst NY

MEASURE ANTENNA IMPEDANCE WITH YOUR SWR BRIDGE

So far, the great majority of antenna impedance bridges that we have found in construction articles are devices that function only with a low power rf source. The run-of-the-mill impedance bridge is designed to operate with a grid dipper as the source of rf excitation. Operation with tube type dippers is generally intended as the transistor dippers produce an rf level that is too low for excitation of this bridge type.

The conventional antenna bridge cannot be left in the transmission line continually as excessive rf energy would soon destroy the device. This means that each time measurement of antenna impedance is desired, the transmission line must be opened and the bridge inserted and grid dip excitation applied. Grid dippers are not necessarily the most accurate rf source for a specific frequency in an amateur band . . . therefore the station receiver must monitor the dipper output for any bridge accuracy. A low power bridge will not often present the true operating impedance of the antenna . . . especially antennas with parasitic elements. A bridge that operates under full transmitter power will present a much more accurate picture of your antenna system at a specific frequency.

Inspiration for the "In Line" full power bridge came from information concerning the standard swr bridge. Just about every amateur has in his possession some sort of swr bridge and the great majority are of the type illustrated in Fig. 1. This bridge consists of a section of transmission line near which are placed two inductors. These inductors are actually two bridges along with their associated diodes and resistors. One of the bridges reads forward power and the other reflected power. The resistors (Rx) at the end of the inductors L1 and L2 are critical for accurate bridge null (balance) and therefore must be the proper value for the specific transmission line used. For the

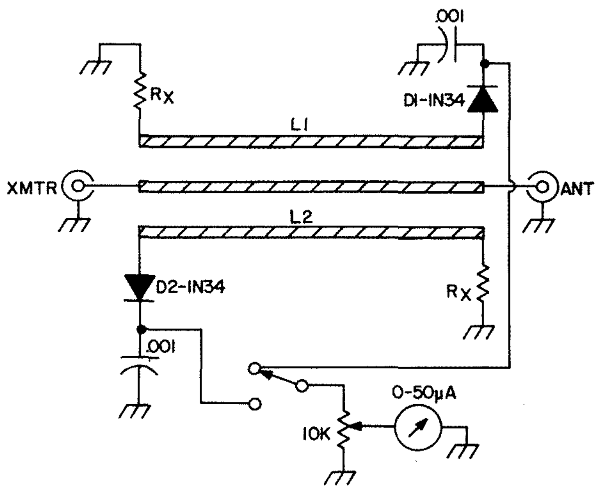


Fig. 1. Conventional swr bridge.

average swr bridge the value for Rx is 100Ω for 75Ω line and 150Ω for 50Ω transmission line. Considering that resistor Rx is critical for the impedance of the line in use, varying the value of Rx and devising a system of calibration for Rx would enable us to determine the impedance of a line when a null is achieved on the bridge meter.

The "reflected" inductor which is LI in Fig. 1 is the portion of the bridge circuit we

are interested in for impedance measurements. The value of Rx and the transmission line must balance the bridge for a null to be realized. Any variation from the above parameters will mean changing the value of Rx so that the bridge again balances at a new impedance value.

By experimenting with various values of resistance at Rx, it was determined that a 1000Ω potentiometer represents a fair value. The 1000Ω potentiometer is inserted in place of Rx on inductor L1 (see Fig. 2). This is the inductor with the diode pickup located toward the load or antenna end of the swr bridge.

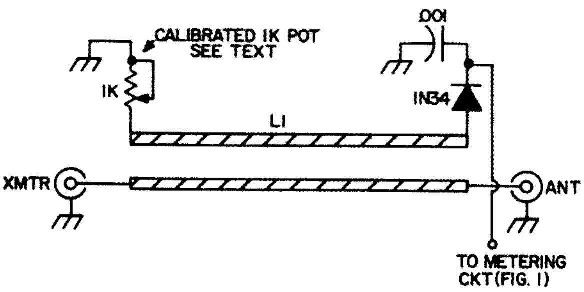


Fig. 2. The modified bridge leads to 1K pot should be as short as possible and shell (case) of pot grounded.

Make sure that all leads to the 1000Ω potentiometer are short and that the metal case (shell) of the potentiometer is well grounded. Excessive lead length or inductance will create inaccuracy of the device. The position of the potentiometer will be determined by the physical layout of your particular swr bridge. It must be set at a point where the shaft can be extended through the front panel of your swr bridge. Allowance must also be made for a dial or other indicating device which can be calibrated in ohms (impedance) on the front panel. It might even be desirable to mount your entire present bridge in another larger case so that all functions can be accommodated.

Calibration of this in-line bridge was the major problem. An ordinary grid dip meter will not provide sufficient excitation for readings. With full power applied, especially a kilowatt, it becomes difficult to find resistive dummy loads of various values to

calibrate the bridge. Even with 100W of rf, proper resistive load values are not common.

The solution to the calibration problem came to us in the form of an (ouch!) CB transmitter. A CB transmitter is fortunate if it is able to put out 3W of rf and at the same time is well within the frequency range of an swr bridge. The most important fact is that a CB transmitter will provide adequate excitation for calibration of the bridge with ordinary 5W 5% carbon (garden variety) resistors. For calibration, a good assortment of these resistors is necessary. Use values such as 5, 27, 47, 75, 100, 150, 220 and 470Ω. Intermediate values can be then interpolated on your scale. The calibration procedure is simple . . . first borrow your neighbor's CB, then attach the 5W resistors across the antenna coax connector of the bridge and excitation of the CB transmitter is applied to the remaining connector on the bridge. The bridge sensitivity should be set for a middle scale reading of the meter and the 1000Ω potentiometer is varied until you reach a null on the meter. Mark the value of the calibration resistors on the potentiometer scale (dial). Do this for all of the available resistors and your bridge will be in fair calibration.

At this point we should mention that this system does not measure reactive components in the antenna system. If your antenna is reactive, either inductive or capacitive, the meter will present a shallow, poorly defined null at the operating frequency. A sharp, well defined null will indicate a purely resistive impedance.

When using the bridge in its former function as an swr bridge, set the resistance dial to the value of your transmission line. When measuring impedance, vary the dial for maximum dip on the meter and read the resistance (impedance) directly.

As a final point, it is wise to insert the swr/impedance bridge at a half-wave or an even multiple of a half-wavelength from your antenna. At half-wave points from the antenna, the antenna impedance is repeated. This will enable your measurements to be much more accurate. When determing half-wavelength points, take into consideration the velocity factor of your particular coax.

. . .W2AOO

Mike Centore III
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POTENTIOMETERS

A second look at uses for an old Component.

I am a homebrew nut. My junkbox runneth over. Wading through that mound of resistors, capacitors, and defunct transistors, not a second passes before I come across a potentiometer.

Pots galore! But what can I use them for? While looking over some commercial gear, I got a few ideas. Here they are.

Figures 1 through 4 show diagrams for voltage-controlling/polarity-shifting devices. They use different methods to achieve a similar effect. Don't confuse them with the common voltage *divider* that you find in any receiver's volume control circuit. Sure, voltage dividers provide a means for varying the amplitude of the voltage, but they can't reverse its polarity. That's where polarity shifters come in. To get an idea of how they work, take a look at Fig. 1. When the wiper of R1 is at point *A* positive nine volts appear at the output. As the wiper is brought nearer point *B* this positive voltage decreases. At point *B* the output voltage is zero. When the wiper passes *B* a negative voltage appears at the output. Finally, it reaches *C*, and −9V is found at the output. Simple enough?

I've found many uses for this type of circuit. Imagine being able to switch your class of bias on experimental transistor amplifiers with the turn of a pot. If you design it right, you can turn a voltage amplifier into a power amplifier and vice versa with "volume control" ease.

As I've said, all of the circuits in Figs. 1–3 do basically the same thing. It's just that they go about it in a different way. Each has its own good and bad points. For example, the circuit of Fig. 1 has the disadvantage of having its output voltage vary greatly with variations in load resistance. The circuit shown in Fig. 2 has a slightly more stable output voltage. It uses two resistors in a bridge circuit. The resistors should be of equal value. Their total series resistance should equal that of the pot. As shown in Fig. 3, two similar pots may be connected in a Wheatstone bridge configuration to achieve the same result.

Remember, in all of these circuits, when the pots are set to center position, the voltage output is zero. When you swing

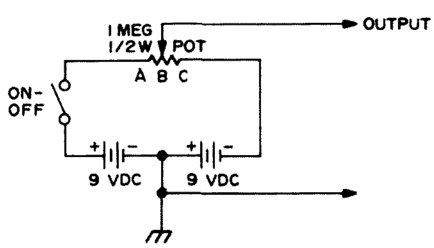

Fig. 1.

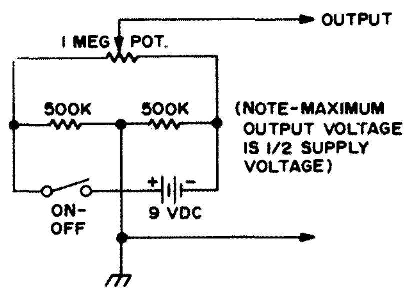

Fig. 2.

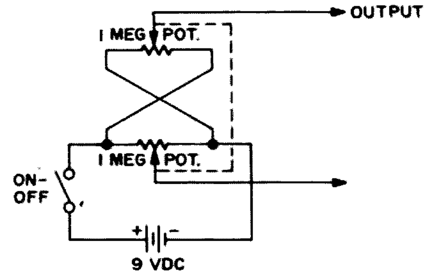

Fig. 3.

past center, the voltage *reverses* its polarity, so don't power a transistor circuit that might be damaged by this. You should also note that linear pots make the best voltage controls. Tapered pots vary the voltage unevenly, and put the "zero-volts" position far off center.

The values shown are typical and have been tested. They should be changed to suit your particular needs. Keep in mind that $P = I^2 R$. Don't draw too much current unless your pots have a high enough wattage rating.

I have found it very convenient to test small diodes with these circuits. Just put a milliammeter in series with the diode and place this across the output voltage of any of the aforementioned circuits. Now swing the pot over its range and measure the diode's reverse current. This technique may also be used to check the junctions in transistors.

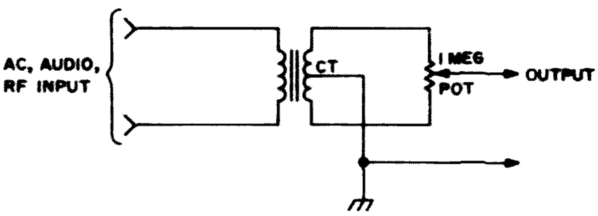

Fig. 4

The circuit shown in Fig. 4 is found in most oscilloscopes to obtain Lissajous patterns. As the pot is swept from one extreme to the other, the *phase* of the output voltage is changed as well as the amplitude of the voltage. The phase will be determined by how far off center the wiper is placed. The input may be connected to standard 60 Hz ac, audio – or rf if you use a suitable transformer.

. . . Centore

Reduce your scaling/resonance ratio:

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Jackson Heights NY 11369

AN IMPROVED METHOD TO PRUNE ANTENNAS

For anyone who desires to install a new antenna, there is always the problem as to how long to make it. At best, the formulas in handbooks are an approximation and the resonant frequency of the antenna will be modified by surrounding objects, the propagation factor of the antenna, and capacitive end effects. Usually these approximations are adequate but we frequently find ourselves pruning the antenna for the best swr at the desired operating frequency. This is a method that will assist pruning the antenna and avoiding innumerable climbs to the roof or cutting the antenna too short.

Compute the antenna length for the low end of the band (146.9 F, where F is the frequency in MHz). The length will be in meters.

Install the antenna and plot the reflected power or swr across the band (Curve A). I used a reflectometer type of swr meter.

Draw a straight line along the slope of the swr curve until it crosses the bottom of the graph (Curve B). This intersection represents the actual resonant frequency of the antenna (Fr).

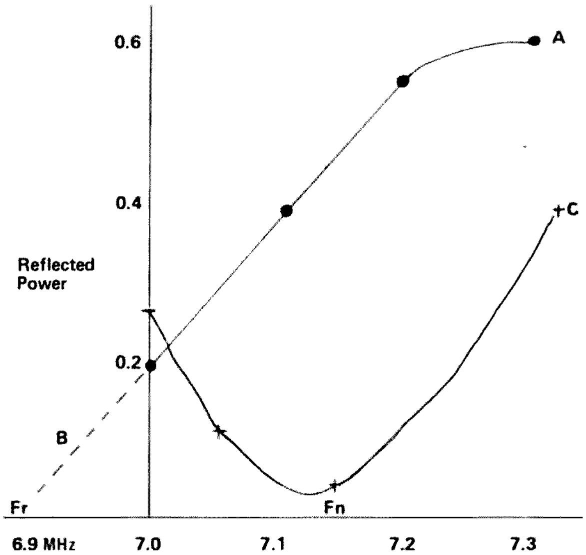
Calculate Fd = Fn - Fr where Fn is the desired resonant frequency of the antenna in MHz.

Calculate the amount the antenna needs to be shortened in meters (Ld).

$$Ld = \frac{146.9 \times Fd}{Fr^2}$$

Make a new swr curve after shortening the antenna by this amount (Curve C). If the resonant frequency is not correct, repeat the procedure.

I used this method on a new 40 meter dipole and I had to prune it twice, which is



$$\text{Antenna length} = \frac{146.9}{F} = \frac{146.0}{7.0} = 20.98 \text{ meters}$$

$$Fd = Fn - Fr = 7.15 - 6.90 = 0.25 \text{ MHz}$$

$$Ld = \frac{146.9 \times Fd}{Fr^2} = \frac{146.9 \times 0.25}{6.9^2} = .77 \text{ meters}$$

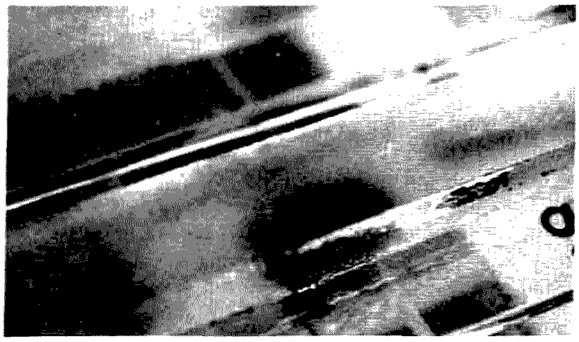
especially nice if one is working by himself. The constant 146.9 is the same as given in the ARRL Handbook corrrected for a 98% velocity factor and expressed metrically. This method can be used with any type of antenna if the appropriate constant is used, whether it be a dipole, ¼ whip, or a director.

. . .W3GAT/2

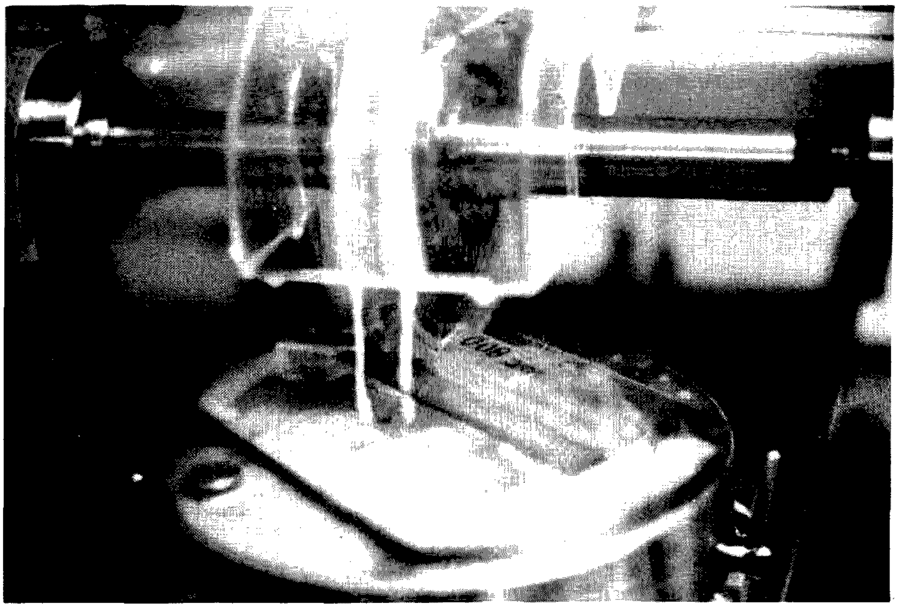
A VISIT TO SENTRY

Picture Story by Wayne Green W2NSD/1

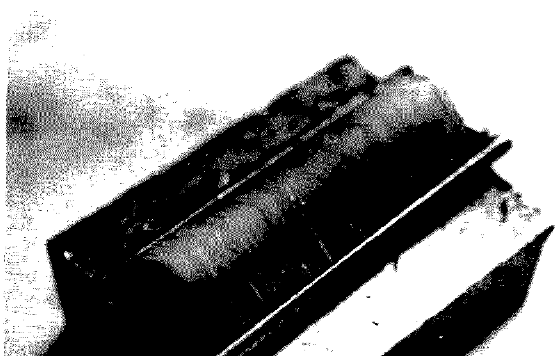
While down in Oklahoma giving a talk to the Oklahoma University radio club, I made a short side trip to Shawnee to stop in and see the crystal making at Sentry. It was most impressive. Sentry is one of the pioneers of crystals for wristwatches and they are into that process extensively. I tried to follow through the process whereby our FM crystals are manufactured.



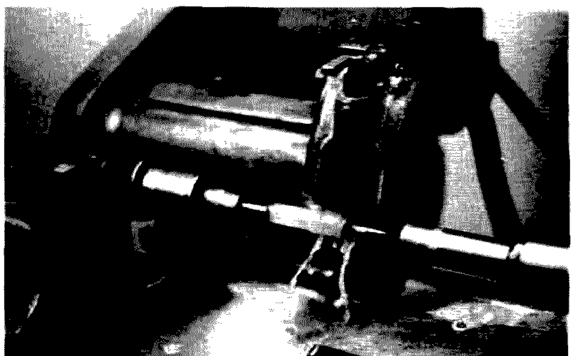
The long bars of quartz crystal are difficult to photograph – they look a lot like bars of ice.



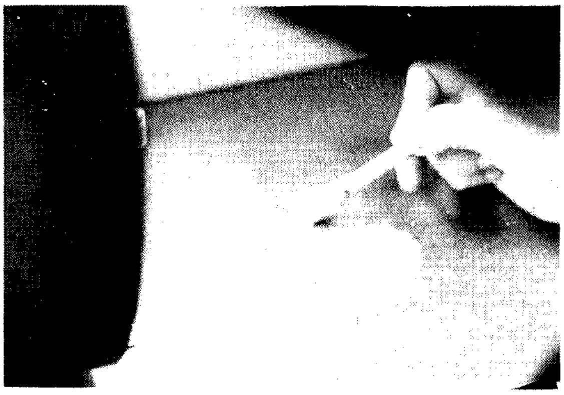
The first step is to cut the quartz into thin slices at an angle to the bar. Here we see the slices being made by a saw. Quartz is difficult to cut and they have to run a lot of coolant on the saw to keep it from getting too hot.



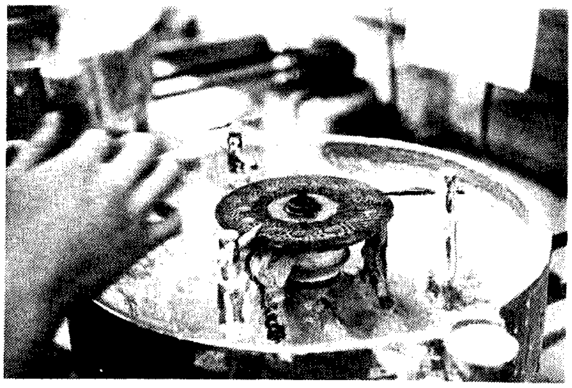
The slices of quartz are put together and clamped for rounding.



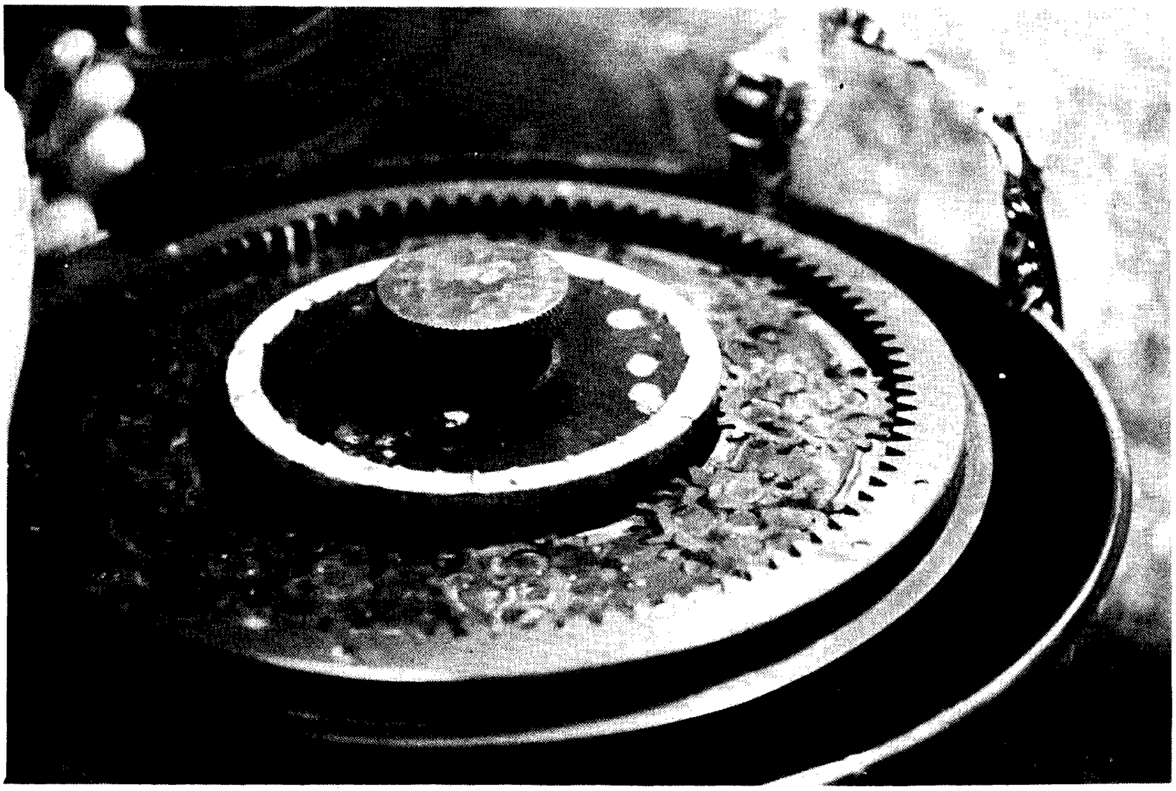
A lathe rounds the slices.



Some of the round slices are not absolutely perfect and they are removed at this time in the process.



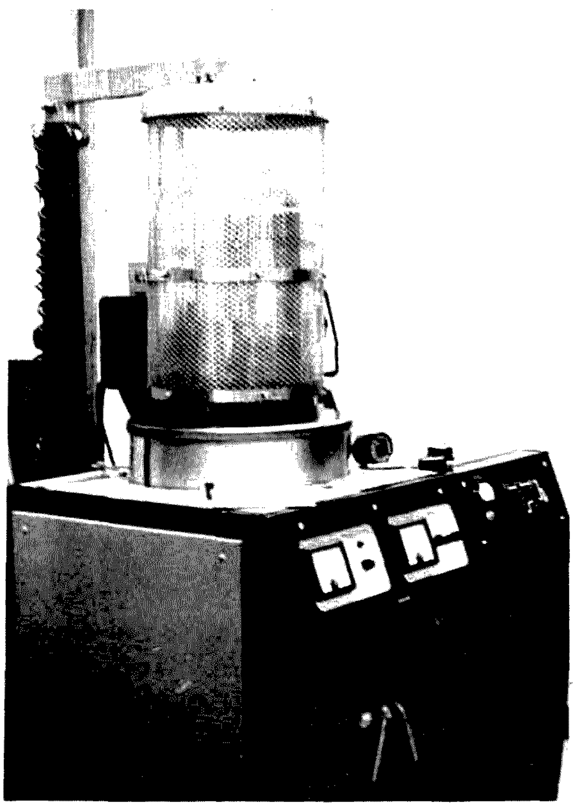
The round crystal blanks are put in this rough grinder a dozen at a time and a grinding sludge is squirted as they are ground down.



Thirty-six crystal blanks go into this final grinder for lapping close to the desired frequency. The crystals are in an oscillator circuit so the operator of the grinder can keep track of their frequency. No two are on exactly the same frequency so the operator swings the knob of an old HQ-129 back and forth, listening to the multitude of oscillations as they move on up the band with grinding.

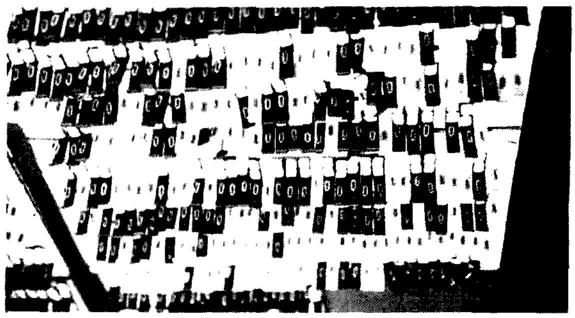
The 129 is at the right and the grinder in the middle – note weights on the crystals to help them grind in.

The crystal blanks are put together with electrodes for gold plating.

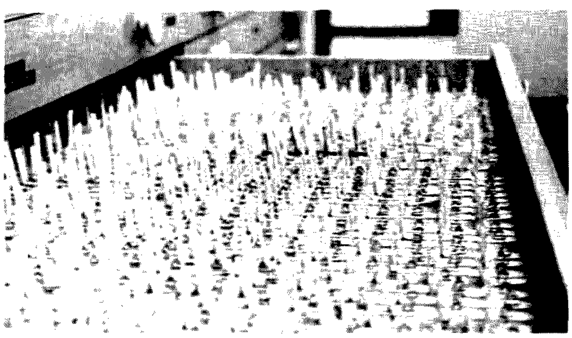


Talk about a gilt complex! This contraption puts gold on the crystals.

Finished crystal in work holder getting ready for the case to be soldered on. The crystals are kept on file in this shape, ready to be zeroed in on the ordered frequency and then put in their cases.



Here are a few hundred crystals ready for finishing



Sentry has thousands upon thousands of crystals ready for the final process, just awaiting your order. They have them by the drawers full.

. . .W2NSD/1

(W2NSD/1 continued from p. 4)

Now we wonder where truth doth lie – and who doth lie? Public savants - - er, servants, don't like a lot of light on themselves, so when someone from the FCC does something unfair to amateurs it is important to bring it out into the light and not try in fear to cover up.

Sex Sells!

It takes months before the figures are in from all of the newsstands around the world, but at last we have the details on how well or poorly our February sex cover did as compared to other issues. We had a bikini clad girl on the February issue and an exciting tower photo on the April issue. February sold 6.8% better on the newsstands than April!.

Big deal? You bet it is – that's over $1000 out of our pockets. It appears that occasional flings at female type covers may drop out a few Baptist ministers and Boy Scout leaders, but it does get more readers – and that means we can put out a little bigger magazine.

How about it you camera bug amateurs, can you come up with some relatively tasteful sexy pictures for our covers – with an amateur radio theme? We work best from 2 ¼" x 2 ¼" or 4" x 5" transparencies.

CURIOUS FCC CONCEPT

A recent talk by Johnny Johnston brought out an odd concept that apparently has taken root in the amateur division thinking – and that is that all petitions for rule changes should be viewed from the aspect of their applicability to the basic reasons for amateur radio as expressed in the regulations. The five are: providing emergency communications – contributing to the advancement of the radio art – advancing skills in the communication and technical phases of the art – expanding the reservoir of trained operators, technicians and electronic experts – enhancing international good will.

While it seems as though we should be able to enter petitions on any matter that is of importance to us, even though it might not bear directly on one of the five purposes of the "service," it would be prudent to keep in mind that this is the way the pendulum has swung for the time being and try to tie in your petitions for change to one or more of these purposes. Apparently this will help them move through the morass in Washington.

WRITING CONGRESS

A call from WN4YRB brought out the idea that many amateurs would like to write to their congressmen, but are stopped because they don't know how.

That's reasonable. How do you address your senator? How do you find out who he is if you don't know?

(Continued on p. 108)

FCC RULES AND REGULATIONS, PART 97 (IV)

CONTENTS THIS MONTH

Subpart C—Technical Standards

97.61 Authorized frequencies and emissions.
97.63 Individual frequency not specified.
97.65 Emission limitations.
97.67 Maximum authorized power.
97.69 Radio teleprinter transmissions.
97.71 Transmitter power supply.
97.73 Purity and stability of emissions.
97.75 Frequency measurement and regular check.

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

SUBPART C—TECHNICAL STANDARDS

§ 97.61 Authorized frequencies and emissions.

(a) Following are the frequency bands and associated emissions available to amateur radio stations, other than repeater stations, subject to the limitations stated in paragraph (b) of this section, §§ 97.65, 97.109, and 97.110.

Frequency band	Emissions	Limitations (see paragraph (b))
kHz		
1800-2000	A1, A3	1, 2
3500-4000	A1	
3500-3775	F1	
3775-3890	A5, F5	
3775-4000	A3, F3	4
7000-7300	A1	3, 4
7000-7150	F1	3, 4
7075-7100	A3, F3	10
7150-7225	A5, F5	3, 4
7150-7300	A3, F3	3, 4
14000-14350	A1	
14000-14200	F1	
14200-14275	A5, F5	
14200-14350	A3, F3	
MHz		
21.000-21.450	A1	
21.000-21.250	F1	
21.250-21.350	A5, F5	
21.250-21.450	A3, F3	
28.000-29.700	A1	
28.000-28.500	F1	
28.500-29.700	A3, F3, A5, F5	
50.0-54.0	A1	
50.1-54.0	A2, A3, A4, A5, F1, F2, F3, F5	
[illegible]0-54.0	A0	
[illegible]-148	A1	
[illegible] 143.0	A0, A2, A3, A4, A5, F0, F1, F2, F3, F5	
220-225	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5.	5, 6
420-450	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5.	5, 7
1215-1300	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5.	5
2300-2450	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5, P.	5, 8
3300-3500	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5, P.	5
5650-5925	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5, P.	5, 9
10000-10500	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5.	5
21000-22000	A0, A1, A2, A3, A4, A5, F0, F5, F2, F3, F4, F5, P.	
Above 40000	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5, P.	

(b) Limitations:

(1) The use of frequencies in this band is on a shared basis with the LORAN-A radionavigation system and is subject to cancellation or revision, in whole or in part, by order of the Commission, without hearing, whenever the Commission shall determine such action is necessary in view of the priority of the LORAN-A radionavigation system. The use of these frequencies by amateur stations shall not cause harmful interference to LORAN-A system. If an amateur station causes such interference, operation on the frequencies involved must cease if so directed by the Commission.

(2) Operation shall be limited to: (Next page).

(3) Where, in adjacent regions or subregions, a band of frequencies is allocated to different services of the same category, the basic principle is the equality of right to operate. Accordingly, the stations of each service in one region or subregion must operate so as not to cause harmful interference to services in the other regions or subregions (No. 117, the Radio Regulations, Geneva, 1959).

(4) 3900-4000 kHz and 7100-7300 kHz are not available in the following U.S. possessions: Baker, Canton, Enderbury, Guam, Howland, Jarvis, Palmyra, American Samoa, and Wake Islands.

(5) Amateur stations shall not cause interference to the Government radiolocation service.

(6) Not available in those portions of Texas and New Mexico bounded by latitude 33°24′ N., and 31°53′ N., and longitude 105°40′ W. and 106°40′ W. between the hours 0500 and 1800 local time, Monday through Friday, except to stations authorized to operate in an organized civil defense network when civil defense emergencies exist or when arrangements have been made with the Commission Engineer in Charge at Dallas, Tex., and the Area Frequency Coordinator at White Sands, N. Mex., for drills at specific dates and times.

(7) In the following areas the d.c. plate input power to the final transmitter stage shall not exceed 50 watts,

(2) Operation shall be limited to:

Area	Maximum DC plate input power in watts							
	1800-1825 kHz	1825-1850 kHz	1850-1875 kHz	1875-1900 kHz	1900-1925 kHz	1925-1950 kHz	1960-1975 kHz	1975-2000 kHz
	Day/Night	Day/Night	Day/Night	Day/Night	Day/Night	Day/Night	Day/Night	Day/Night
Alabama	500/100	100/25	0	0	0	0	100/25	500/100
Alaska	1000/200	500/100	500/100	100/25	0	0	0	0
Arizona	1000/200	500/100	500/100	0	0	0	0	0
Arkansas	1000/200	500/100	100/25	0	0	100/25	100/25	500/100
California	1000/200	500/100	500/100	100/25	0	0	0	0
Colorado	1000/200	500/100	200/50	0	0	0	0	200/50
Connecticut	500/100	100/25	0	0	0	0	0	0
Delaware	500/100	100/25	0	0	0	0	0	100/25
District of Columbia	500/100	100/25	0	0	0	0	0	100/25
Florida	500/100	100/25	0	0	0	0	100/25	500/100
Georgia	500/100	100/25	0	0	0	0	0	200/50
Hawaii	0	0	0	0	200/50	100/25	100/25	500/100
Idaho	1000/200	500/100	500/100	100/25	100/25	100/25	100/25	500/100
Illinois	1000/200	500/100	100/25	0	0	0	0	200/50
Indiana	1000/200	500/100	100/25	0	0	0	0	200/50
Iowa	1000/200	500/100	200/50	0	0	100/25	100/25	500/100
Kansas	1000/200	500/100	100/25	0	0	100/25	100/25	500/100
Kentucky	1000/200	500/100	100/25	0	0	0	0	200/50
Louisiana	500/100	100/25	0	0	0	0	100/25	500/100
Maine	500/100	100/25	0	0	0	0	0	0
Maryland	500/100	100/25	0	0	0	0	0	100/25
Massachusetts	500/100	100/25	0	0	0	0	0	0
Michigan	1000/200	500/100	100/25	0	0	0	0	100/25
Minnesota	1000/200	500/100	500/100	100/25	100/25	100/25	100/25	500/100
Mississippi	500/100	100/25	0	0	0	0	100/25	500/100
Missouri	1000/200	500/100	100/25	0	0	100/25	100/25	500/100
Montana	1000/200	500/100	500/100	100/25	100/25	100/25	100/25	500/100
Nebraska	1000/200	500/100	200/50	0	0	100/25	100/25	500/100
Nevada	1000/200	500/100	500/100	100/25	0	0	0	0
New Hampshire	500/100	100/25	0	0	0	0	0	0
New Jersey	500/100	100/25	0	0	0	0	0	0
New Mexico	1000/200	500/100	100/25	0	0	100/25	500/100	1000/200
New York	500/100	100/25	0	0	0	0	0	0
North Carolina	500/100	100/25	0	0	0	0	0	100/25
North Dakota	1000/200	500/100	500/100	100/25	100/25	100/25	100/25	500/100
Ohio	1000/200	500/100	100/25	0	0	0	0	100/25
Oklahoma	1000/200	500/100	100/25	0	0	100/25	100/25	500/100
Oregon	1000/200	500/100	500/100	100/25	0	0	0	0
Pennsylvania	500/100	100/25	0	0	0	0	0	0
Rhode Island	500/100	100/25	0	0	0	0	0	0
South Carolina	500/100	100/25	0	0	0	0	0	200/50
South Dakota	1000/200	500/100	500/100	100/25	100/25	100/25	100/25	500/100
Tennessee	1000/200	500/100	100/25	0	0	0	0	200/50
Texas	500/100	100/25	0	0	0	0	0	200/50
Utah	1000/200	500/100	500/100	100/25	100/25	0	0	100/25
Vermont	500/100	100/25	0	0	0	0	0	0
Virginia	500/100	100/25	0	0	0	0	0	100/25
Washington	1000/200	500/100	500/100	100/25	0	0	0	0
West Virginia	1000/200	500/100	100/25	0	0	0	0	100/25
Wisconsin	1000/200	500/100	200/50	0	0	0	0	200/50
Wyoming	1000/200	500/100	500/100	100/25	100/25	0	0	200/50
Puerto Rico	500/100	100/25	0	0	0	0	0	200/50
Virgin Islands	500/100	100/25	0	0	0	0	0	200/50
Swan Island	500/100	100/25	0	0	0	0	100/25	500/100
Serrana Bank	500/100	100/25	0	0	0	0	100/25	500/100
Roncador Key	500/100	100/25	0	0	0	0	100/25	500/100
Navassa Island	500/100	100/25	0	0	0	0	0	200/50
Baker, Canton, Enderbury, Howland	100/25	0	0	100/25	100/25	0	0	100/25
Guam, Johnston, Midway	0	0	0	0	100/25	0	0	100/25
American Samoa	200/50	0	0	200/50	200/50	0	0	200/50
Wake	100/25	0	0	100/25	0	0	0	0
Palmyra, Jarvis	0	0	0	0	200/50	0	0	200/50

except when authorized by the appropriate Commission Engineer in Charge and the appropriate Military Area Frequency Coordinator.

(i) Those portions of Texas and New Mexico bounded by latitude 33°24′ N., 31°53′ N., and longitude 105°40′ W. and 106°40′ W.

(ii) The State of Florida, including the Key West area and the areas enclosed within circles of 200-mile radius centered at 28°21′ N., 80°43′ W. and 30°30′ N., 86°30′ W.

(iii) The State of Arizona.

(iv) Those portions of California and Nevada south of latitude 37°10′ N. and the area within a 200-mile radius of 34°09′ N., 119°11′ W.

(8) No protection in the band 2400–2450 MHz is afforded from interference due to the operation of industrial, scientific, and medical devices on 2450 MHz.

(9) No protection in the band 5725–5875 is afforded from interference due to the operation of industrial, scientific, and medical devices on 5800 MHz.

(10) The use of A3 and F3 in this band is limited to amateur radio stations located outside Region 2.

(c) The following transmitting frequency bands and the associated emission authorized in paragraph (a) of this section are available for repeater stations, including both input (receiving) and output (transmitting):

Frequency Band (MHz)

52.0–54.0

146.0–148.0

222.0–225.0

442.0–450.0

any amateur frequency above 1215 MHz.

The frequency band 29.5–29.7 MHz may be authorized upon a special showing of need for repeater station operation in this band for intracommunity amateur radio communications.

[§ *97.61(a) intro. amended and (c) added new eff. 10-17-72; and Table in (a) amended and (b)(10) added new eff. 11-22-72; VI(72)-1*]

§ 97.63 Individual frequency not specified.

Transmissions by an amateur station may be on any frequency within any authorized amateur band. Sideband frequencies resulting from keying or modulating a carrier wave shall be confined within the authorized amateur band.

§ 97.65 Emission limitations.

(a) Type AØ emission, where not specifically designated in the bands listed in § 97.61, may be used for short periods of time when required for authorized remote control purposes or for experimental purposes. However, these limitations do not apply where type AØ emission is specifically designated.

(b) Whenever code practice, in accordance with § 97.91(d), is conducted in bands authorized for A3 emission, tone modulation of the radiotelephone transmitter may be utilized when interspersed with appropriate voice instructions.

(c) On frequencies below 29.0 MHz and between 50.1 and 52.5 MHz, the bandwidth of an F3 emission (frequency or phase modulation) shall not exceed that of an A3 emission having the same audio characteristics; and the purity and stability of emissions shall comply with the requirements of § 97.73.

(d) On frequencies below 50 MHz, the bandwidth of A5 and F5 emissions shall not exceed that of an A3 single sideband emission.

(e) On frequencies between 50 MHz and 225 MHz, single sideband or double sideband A5 emission may be used and the bandwidth shall not exceed that of an A3 single sideband or double sideband signal respectively. The bandwidth of F5 emission shall not exceed that of an A3 single sideband emission.

(f) Below 225 MHz, A3 and A5 emissions may be used simultaneously on the same carrier frequency provided the total bandwidth does not exceed that of an A3 double sideband emission.
(T.S. VI(72)-1)

§ 97.67 Maximum authorized power.

(a) Except for power restrictions as set forth in § 97.61, each amateur transmitter may be operated with a power input not exceeding 1 kilowatt to the plate circuit of the final amplifier stage of an amplifier-oscillator transmitter or to the plate circuit of an oscillator transmitter. An amateur transmitter operating with a power input exceeding 900 watts to the plate circuit shall provide means for accurately measuring the plate power input to the vacuum tube or tubes supplying power to the antenna.

(b) Notwithstanding the provisions of paragraph (a) of this section, amateur stations shall use the minimum amount of transmitter power necessary to carry out the desired communications.

(c) Within the limitations of paragraphs (a) and (b) of this section, the effective radiated power of a repeater station shall not exceed that specified for the antenna height above average terrain in the following table:

Antenna height above average terrain	Maximum effective radiated power for frequency bands above:			
	52 MHz	146 MHz	442 MHz	1215 MHz
Below 50 feet	100 watts	800 watts	Paragraphs (a) and (b).	----------
50 to 99 feet	100 watts	400 watts	do	----------
100 to 499 feet	50 watts	400 watts	800 watts	Paragraphs (a) and (b).
500 to 999 feet	25 watts	200 watts	800 watts	Do.
Above 1,000 feet	25 watts	100 watts	400 watts	Do.

[§ 97.67 intro. text designated as (a), and (b) & (c) added new eff. 10-17-72; VI(72)-1]

§ 97.69 Radio teleprinter transmissions.

The following special conditions shall be observed during the transmission of radio teleprinter signals on authorized frequencies by amateur stations:

(a) A single channel five-unit (start-stop) teleprinter code shall be used which shall correspond to the International Telegraphic Alphabet No. 2 with respect to all letters and numerals (including the slant sign or fraction bar) but special signals may be employed for the remote control of receiving printers,

or for other purposes, in "figures" positions not utilized for numerals. In general, this code shall conform as nearly as possible to the teleprinter code or codes in common commercial usage in the United States.

(b) The normal transmitting speed of the radio teleprinter signal keying equipment shall be adjusted as closely as possible to one of the standard teleprinter speeds, namely, 60 (45 bauds), 67 (50 bauds), 75 (56.25 bauds) or 100 (75 bauds) words per minute, and in any event, within the range of ±5 words per minute of the selected standard speed.

(c) When frequency shift keying (type F1 emission) is utilized, the deviation in frequency from the mark signal to space signal, or from the space signal to the mark signal, shall be less than 900 hertz.

(d) When audio frequency shift keying (type A2 or type F2 emission) is utilized, the highest fundamental modulating audio frequency shall not exceed 3000 hertz, and the difference between the modulating audio frequency for the mark signal and that for the space signal shall be less than 900 hertz.

§ 97.71 Transmitter power supply.

The licensee of an amateur station using frequencies below 144 megahertz shall use adequately filtered direct-current plate power supply for the transmitting equipment to minimize modulation from this source.

§ 97.73 Purity and stability of emissions.

Spurious radiation from an amateur station being operated with a carrier frequency below 144 megahertz shall be reduced or eliminated in accordance with good engineering practice. This spurious radiation shall not be of sufficient intensity to cause interference in receiving equipment of good engineering design including adequate selectivity characteristics, which is tuned to a frequency or frequencies outside the frequency band of emission normally required for the type of emission being employed by the amateur station. In the case of A3 emission, the amateur transmitter shall not be modulated to the extent that interfering spurious radiation occurs, and in no case shall the emitted carrier wave be amplitude-modulated in excess of 100 percent. Means shall be employed to insure that the transmitter is not modulated in excess of its modulation capability for proper technical operation. For the purposes of this section a spurious radiation is any radiation from a transmitter which is outside the frequency band of emission normal for the type of transmission employed, including any component whose frequency is an integral multiple or submultiple of the carrier frequency (harmonics and subharmonics), spurious modulation products, key clicks, and other transient effects, and parasitic oscillations. When using amplitude modulation on frequencies below 144 megahertz, simultaneous frequency modulation is not permitted and when using frequency modulation on frequencies below 144 megahertz simultaneous amplitude modulation is not permitted. The frequency of the emitted carrier wave shall be as constant as the state of the art permits.

§ 97.75 Frequency measurement and regular check.

The licensee of an amateur station shall provide for measurement of the emitted carrier frequency or frequencies and shall establish procedure for making such measurement regularly. The measurement of the emitted carrier frequency or frequencies shall be made by means independent of the means used to control the radio frequency or frequencies generated by the transmitting apparatus and shall be of sufficient accuracy to assure operation within the amateur frequency band used.

(To be continued next month)

Gay E. Milius, Jr. W4NJF
1416 Rutland Drive
Virginia Beach VA 23454

THE QSL MANAGER . . .

. . . is he behind the two-year time-lapse between working that rare DX station and finally receiving your card? A hard working QSL Manager tells his side of the story.

DXing is one half making the contact, and the other half getting the QSL to confirm the contact. Much has been said about how to QSL so as to entice a DX station to send a QSL. Nevertheless, the DXer should also know how to QSL to the QSL Manager. The latter sees many cards with many errors, and he is in a position to explain how to QSL properly and get better and speedier results.

Being a QSL Manager, I have discovered many DXers do not use Greenwich mean time and do not set their clocks by WWV, while the DX stations, as a rule, are quite careful of the time they use in their logs. This accounts for great discrepancies between QSL time and log time. Many beginning DXers continue to use their local time, while all worldwide DXers use GMT. Thus, more confusion ensues because the QSL Manager cannot stop to translate local time to GMT; at the same time it leads to incorrect dates, which in turn leads to no QSL from the QSL Manager. In an active DX log, one day may cover many pages. Obviously, when faced with a huge pile of QSL's, the Manager cannot stop to go through page after page, searching for an entry which might or might not be there.

Using GMT obliges one to remember that in the EST zone, the new day starts at 7:00 p.m. – ESDT zone, it starts at 8:00 p.m. In the CST zone, the new day commences at 6:00 p.m., and in CDST, 7:00 p.m. is the magic hour. This goes on across the country through MST and PST, etc. Remember the above, and log your QSO's accordingly. Then the QSL's will be sent out promptly with the correct time and dates.

Each QSL Manager has his own method of disposing of a large batch of cards. Usually the cards are first sorted according to date and time. Then it is simple to go right down the log, checking them off. But one annoying thing is to have all the QSL data on the back of the card and the call sign on the front. The QSL Manager must then turn each card over, using up valuable time and energy. Your cards should have all the information and call sign on one side. However, if you are aesthetic and insist on a two-sider, then for heaven's sake also put your call sign in small but fairly readable type on the same side as the QSL data. In this category, give a thought to the rising cost of postage and do not print your cards on heavy stock. If you send a batch of cards to a bureau, you can send many more light, thin cards than the thick, fancy variety. Who will know the difference? The QSL Manager doesn't care how the cards look, because in many cases the cards he receives never go any further than his attic or wastebasket. The DX stations, as a rule, don't care to have thousands of W/K cards. And in this vein, it seems futile to write notes on your cards which are sent to QSL Managers, because the

notes hardly ever reach the guy to whom you are writing. It is much nicer to drop the QSL Manager a short note thanking him for his efforts, which are generally given gratis.

Furthermore, always put your call sign on your return envelope. Cards have a habit of separating from the return envelope. Next, remember that just because a card is sent to a bureau doesn't mean that it costs nothing for the reply to be sent to you. The United States has no outgoing bureau, as do many other countries. It costs a great deal for a QSL Manager to send cards back to you via a bureau; many times, the DX station does not send the manager money to pay for that service. Therefore, if you really want a card from a manager, send him a self-addressed, stamped envelope (sase). You will receive a reply as soon as the manager receives the logs. But if you ship your card via the bureau, you may have to wait an indeterminable time to get your QSL in return. In this respect, if the manager handles more than one DX station, it is best to send an envelope for each station. Why? Well, the logs for one station may be at hand but the logs for the second station may not show for a year. So your cards will be delayed that much. I have been helping W2GHK, and sometimes he receives seven cards for seven stations with one return envelope. It may be that seven different people help Stu, and your cards wander all over the Eastern Seaboard before they get in the mails to you.

If you do not receive a fairly prompt reply from the QSL Manager, you must realize that he either doesn't have the logs or he cannot find you in the logs he does have. Not being facetious, I have noticed that CW cards are the ones which are usually sent for QSO's not in the logs, as the operator thinks he heard his call, while in reality the DX station was calling someone else with a similar call. And talking about not receiving logs, there is a lot of that going around. It is either due to the inefficient postal system or the procrastination of the DX station. Many a QSL Manager has had to give up because he was unable to get logs from the DX station.

Let me elaborate on another small item: writing the dates so they can be understood. *Around the world* (other than the United States) and in the military, *dates are written with the month in the middle.* Communication-wise, this is the best method whether the month is written out, set in roman numerals or arabic numerals. Most of the world writes Christmas as 25 December 1972, 25 XII 72 or 25/12/72. But here in the U.S., most people follow their early schooling by placing the month first: December 25, 1972; 12/25/72. This is not too confusing because the 25 in the middle can only be a day. However, look what happens with July, etc., – Independence Day is 7/4/72. What does the guy mean? April 7 or July 4? I maintain we should all use the month-in-the-middle method.

On the postage situation, please remember that you should not use an airmail envelope with its red, white and blue edges, unless you have sufficient postage on it to cover air mail, rather than surface. So unless you do this, don't send fancy air envelopes without supplying sufficient postage or International Reply Coupons for airmail. At the same time, for our overseas brethren, try

not to send U.S. IRC's to a U.S. QSL Manager. U.S. IRC's are for U.S. personnel to send *out* of their country. U.S. QSL Managers can't take them to a post office to get postage. Naturally, they may be kept to use to send for a QSL out of this country, but when a QSL Manager gets inundated with U.S. IRC's, he sometimes can't afford to send out the envelopes with his own money.

Now, as to how many IRC's to send for airmail from a certain country, it is best to check the Call Book and even that is incorrect at times. For example, a Nauru station told me it takes 3 IRC's for airmail there; the Call Book says it takes 4. It takes 2 IRC's for one-half ounce letter airmail to send a letter from the U.S. out of the country. True, there is a difference whether it goes to the Caribbean, Central or South America, or to the rest of the world. Central and South America and the Caribbean cost 17¢ per half ounce, while the rest of the world costs 21¢ for airmail, but one IRC rates only a 15¢ stamp good enough for surface mail, and thus two IR's are required.

Here are a few more hints. When you enclose your return envelope, always try to put it in the transmitting envelope by folding in half and placing the opened side *up*. In this way, when the QSL Manager slices the outside envelope with a letter opener, he will not also slice your return envelope in half. Furthermore, try to turn the flap of the return envelope outward and back on its front. Many envelopes are received glued tight and have to be tossed out. That means providing another envelope and addressing it; a time-consuming and costly task for the QSL manager.

In conclusion, be certain of the QSL Manager's address. Double check your Call Book list because frequently cards are sent to the fellow above or below the QSL Manager you desire. Your card will never reach its destination this way.

Many DX stations are active contest operators. Usually contest logs are separate from regular day-to-day logs. Therefore, when you QSL for a contest QSO, always mark the card to indicate that fact. It will save a lot of time. Good DXing,

. . .W4NJF

(Social Events cont. from p. 10)

ROANOKE CONVENTION

The 1973 Roanoke Division Convention will be held at the Sheraton Inn and International Convention Center at Reston, Virginia on September 14-16. Technical symposiums, displays, exhibits and sessions such as AMSAT, SSTV, DX, Moon Bounce, FM, FCC, ARPSC, New Techniques, Traffic Nets and Contests will be held. Contact: K4MD at P. O. Box 7388, Warrenton, Va. 22186.

IN ARC-Fest

Sept. 30, 1973 Grant County ARC Annual Hamfest at 4-H park, Marion, Ind. Admission donation $1.00, XYL 50¢,children under 12 free. Large inside and outside flea market and exhibit area (no set up charge), food, drawings, tech sessions, camping, ladies bingo. Call in .94 Simplex. For flyer write H. Pence WB9GAT, 524 S. Washington, Montpelier, Indiana 47359.

MELBOURNE HAMFEST

The 8th Annual Melbourne Hamfest will be held September 8th and 9th at the Melbourne Civic Auditorium. Hours 9AM – 4PM. Advance registration $1.00, at the door $1.50. 25,000 sq. ft. swap area, parking for 2,000 cars free, 100% airconditioned building. The childrens entertainment will be a full length Walt Disney Movie, a fishing derby, novice symposium, radio controlled boats and airplanes, and a left footed code contest. A buffet style Hamfest Banquet for everyone Saturday 7PM. Contact: Donald E. Sanders W4BWS, 1422 Virginia Dr., Melbourne, Florida 32935.

PEORIA HAMFEST

The Peoria Area Amateur Radio Club, Inc. will hold it's 16th annual Hamfest Sunday, September 16, 1973, at Exposition Gardens (same place as last year), located on the northwest edge of Peoria, Illinois. Lunch will be available. There will be plenty of activities for the entire family, beginning with the campsite opening the preceeding evening and the banquet Sat., Sept. 15, at V Junction, $5.50 per person. Door prizes for men and women, cocktail hour 5:30 to 6:30, dinner 6:30. Two motels within walking distance. Free coffee and donuts from 9:00 to 9:30 AM GDT. Advance $1.50, at the gate $2.00. For further details and advance registration for banquet contact Larry Pearsall W9FDY, 2224 W. Herold Ave., Peoria, Ill. For Hamfest tickets write Wendell McWilliams, WB9DVJ, P. O. Box 1, Rome, Illinois 61562.

SHARON AUCTION

The Sharon Amateur Radio Association is holding an auction on September 16, 1973. It will take place at the Sharon Community Center in Sharon and will begin at 1:00 P. M. Inquiries should be addressed to David Sirkin, 18 Gorwin Drive, Sharon, Mass., 02067. (617) 784-2276.

WICHITA HAMFEST

On Sept. 9, 1973 the Wichita Amateur Radio Club will have its annual Hamfest at the Sedgwick County 4-H Building. It is located on the N. W. corner of West St. and Central Ave. in West Wichita. For those people who don't know the Wichita area there will be talk-ins on: 3.920 MHz, 7.275 MHz, 146.34 MHz, 146.94 MHz. MARS, ARRL and Kansas Net Meetings. Games, Free soft drinks, and Prizes. Starts 10:00 AM ends 4:00 PM C. D. T. Admission $1.75. Write: Todd Gearheart, 1320 Summitlawn Ct., Wichita, Kansas 67212.

CHECK-OUT MA

Middlesex A. R. C. Pi-Net is looking for check-ins. The net meets weekly September through June on Wednesday evenings at 8:00 P. M., E.S.T. or E.D.T. on 28.68 MHz. The primary purpose of the net is rag chewing and to provide a place to exchange views, information, news, etc. Traffic in and out of Boston area will be gladly handled – ANYONE and EVERYONE is invited to check-in. Colorful net certificates are issued for continued attendence of ten check-ins during twelve months.

CINCINNATI HAMFEST

The 36th Annual Hamfest will be held Sunday, September 16, 1973 at Stricker's Grove on State Route 128, one mile west of Ross (Venice), Ohio. Check local area map for location. Lots of food, flea market, contests, and model aircraft flying. $7.00 covers everything. For further information contact: Jim Wellman, W8HSI, 725 Stout Avenue, Wyoming, Ohio 45215.

CHICAGO HAMFEST

The Chicago Amateur Radio Club announces it's 4th annual Hamfest & Mini-Auction on September 30th, 1973. Time: 2PM till last deal made at St. Viator's School parking lot, 3606 N. Kedvale, N-W corner of Addison St. Donation at gate $1.50 or for advance $1.00 tickets contact: Don De Jong, W9KUJ, 6158 W. Grand Ave., Chicago, Ill., 60639. Ph. 889-329 or KL. 5-3622.

W9DXCC

On September 29, 1973 the Indianapolis DX Association will host the 21st annual meeting of the W9 Central Division Century Club. It will be an afternoon and evening affair at the Highland Park Holiday Inn near Chicago.

FINDLAY OHFEST

The Findlay Annual Hamfest will be held at Riverside Park in Findlay, Ohio – Sunday, Sept, 9 – Advance Donation Tickets $1.00 from C. Foltz W8UN, W. Hobart, Findlay, Ohio 45840.

HAMBURGFEST

Announcing the 1973 Hamburg International Hamfest, Saturday, September 15, 1973, at 9:00 A.M. at the Erie County Fairgrounds in Hamburg, New York. Admission: $2.50 at gate, $2.00 in advance. $1.00 admission to flea market parking. Children under 12 admitted free. Free parking for cars outside of flea market. Talk-in on 34/94, and on 7.255 and 3.925. For tickets and information contact: Lin Brownell, WB2HCL, 210 Buffalo St., Hamburg, New York 14075, (Tel. 716-649-3106).

MARS CONFERENCE

Air Force MARS will hold its first annual Eastern Division Conference on September 7th, 8th, and 9th, in the Washington, D. C. area. The conference will be held in the new Quality Inn in Pentagon City, Virginia.

The highlight of the conference will be the ganquest and awards presentation which will start at 8:00 P. M. on Saturday, September 8th. The guest speaker will be Senator Barry Goldwater, AFA7UGA. Inquiries and further information may be the banquet and awards Conference, P. O. Box 2836, EADS Station, Arlington, Virginia 22202.

W-10-W CERTIFICATE

The Puget Sound Council of Amateur Radio Clubs will issue a certificate signed by Governor Daniel J. Evans for contacts made during Washington State Amateur Radio Week, September 8th to 16th, 1973. Out of state hams must contact 10 Washington hams, and in state hams must contact 20 other Washington hams during this period. Send list of stations contacted, their locations, dates of contact, your name, call, address, and a self-addressed stamped legal size envelope to: The Puget Sound Council of Amateur Radio Clubs, 12306 80th Ave. East, Puyallup, Washington 98371.

DX FOOTNOTES

Gus Browning W4BPD
Drawer "DX"
Cordova, SC 29039

It still amazes me to see that the gang is still "in there" working DX on 160. I would suppose the fact that certain DX is on the other side of the equator where it's winter-time. Ten meters is just about for the birds right now and we all hope will sort of come to life when good old winter-time arrives. 15 is pretty good at times and our "bread and butter" DX band, 20 is still your best bet for DX and if you can battle the broadcast QRM and at times thunderstorm QRN you can find some pretty good stuff on 40. So "hang in there" fellows, the stuff is where you find it, if you will hunt.

We are still waiting for stickers for your WTW certificates to be delivered from the printers. No, I cannot print these fancy stickers, maybe I could learn how, but, life is just too short to be bothered !). When WTW at first was started we were issueing separate printed certificates for each WTW plateau (WTW-100, WTW-200 etc). When the award was given to Dave, K2AZ to manage, these separate certificates was changed over to the basic single WTW-100 certificate with stickers when you work the other plateaus. Those lucky ones who received the separate certificates will one of these days have "collector" material - Hang on to them fellows ! Except for sending out the "stamps" I have been pretty well keeping up with both the WTW and 73-73-73 certificates work, send me in your applications. EXCEPT those of you living in W1/K1, W2/K2, W3/K3, we have a very wide awake club to act as our verification check-point. Its:
Thomas Edison Radio Club,
QSL manager - WB2FVO
AND for the eighth district it's:
Blossomland Amateur Radio Assoc.
222 Jamesway
Benton Harbor
Michigan - 49022

This column is being written while I am under a lot of stress and strain because tomorrow morning I am away along with my XYL and daughter on a 3500 to 4000 mile tour of the Rocky Mountain areas, Grand Canyon, New Mexico, Texas, Louisiana etc. So I may jump from one subject to something entirely different. So doggoned many things to remember to do and so little time to do them in and each one is very important to do, before I can go. I like to take things "easy" and this "rushing" is not for me.

I suppose Wayne will be telling us about his trip over to Jordan because they told me at the 73 offices over the telephone that Wayne had made another trip over there. Maybe he will give us a personal report how each band sounded over in the Mid-East. (wish I was along with him, I sure am anxious to again be on the other end of some DX pile-ups !, maybe that "day" will arrive next year. Sure do want to be DX again. DXing can get in a fellows blood and I suppose it stays with you the rest of your life, and that makes it hard for a fellow that's not loaded with loot ! I believe Wayne has had the bug to bite him, too ! - hi.

Have any of you ever thought of becoming a QSL manager of some rare, active DX station ? I have asked any number of these QSL managers, Why ? Have got all kind of answers, the best answer so far came from WB2FVO (QSL manager for: DU1EN, ex-KG4ER -now in CN8 land, 7X2AD, and MP4BIN) he said he was a "nut", and then proceeded to give a good many other "good" reasons, all of them very good and reasonable. All I can say is "bravo" to them all, this in my book is nothing but "hard work". Their task would be much easier if all the cards sent them was filled out properly and for goodness sake be sure YOUR CARD has YOUR CALL on BOTH SIDES, always use ONLY GMT and be sure that the date is the GMT date - not necessarily YOURS. Many fellows don't seem to understand this fact. Just try to picture where the sun is in England and what day it is over there, and you HAVE IT. A nice "thank you" note to the QSL manager is very much appreciated. A little "donation" to help the QSL manager with HIS EXPENSES is a very good gesture. Always send along a self- addressed, stamped envelope is a "must" with EVERY CARD, and put on the outside of this envelope the call of the DX station or some dope regarding the card you want. ALLOW plenty of time for your card because sometimes he has to wait for the logs of the DX station. Last but not least - DON'T WRITE A NASTY LETTER OR NOTE to him, he is not getting "paid" for his services, he is trying to help YOU !

CHINA NOTE: EP2PR (K4HLJ) is heading for Peking China (working for our government, Embassy, consul or something like that) so it may be that we will soon be hearing a "BY" station being operated by an American. Now, this is when you would hear the darndest pile-up you have ever heard in a long time. (tnx to Buddy, W4BBP for this info).

DXpedition of the month info:
If you want to receive a few times a year a nice little DX news sheet "free" you might drop a note to Stu-W2GHK/4 along with a nice large stamped, self addressed envelope and he will send you the next issue.

OGASAWARA ISLAND DXPEDITIONS: I keep getting info about the JA boys going to these islands on DXpeditions (the prefix is JD) and at times I look at one of the "late-late shows" on TV that has all JA actors. These are usually "monster" pictures and many wierd mountain and sea coast scenes are shown. I wonder if I am looking at some pictures made on these Ogasawara islands. Maybe I have seen some of the JA hams in a scene ? It might be - Who knows ?

JY - JORDAN - Silver Certificates: Work 6 different JY prefixes and you can get one of these beautiful, FB looking certificates. Send the dope to Box 2353, Amman, Jordan.

I overheard someone telling another DXer his version of why the French wont let anyone go to Clipperton Is. (FO8 is their prefix for Clipperton). He said he thought that "maybe" there was a lot of radioactive fallout on the island from some of the French A bomb tests held in the Pacific. I sure would like to know the "real reason", in case anyone really knows the truth. OR, maybe your "own" opinion as to why no one has been successful in obtaining a "permit" to go there and operate. There must be some "good" reason for this situation and it must be a high level "secret" of some sort. It begins to look like it may be easier to operate from China before anyone else gets back to Clipperton Island - Lets see which comes first, Clipperton Island or China.

A BIG P.S. about our first, second and third districts WTW check point, the address to send your cards to be checked is:
The Thomas A. Edison Amateur Radio Association,
c/o WB2FVO Club QSL Manager,
William W. Inkrote, Jr.,
52 Elliot Place,
Edison, N.J. - 08817

Bill will give you fast service I am sure. We will be leaving for our "out west" trip in the next few hours and I will be telling you about some of the DXers I meet along the line of our travels. You know they live in the one part of the USA where I would suppose working DX is at times quite a problem with the west coast covering them in the Pacific and Asia, the East Coast eating them up alive into Europe and Africa and the W4's and W5's gobbling them up into South America - EXCEPT when they have the "skip" with them. Nothing I know of yet can beat Ole Man "skip".

Thats it till next month fellows-Gus-

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTEST CALENDAR

Sep 8–10	Four-Land QSO Party
Sep 15–17	Washington State QSO Party
Sep 15–17	Pennsylvania QSO Party
Sep 22–23	VE/W Contest
Sep 29–Oct 1	Delta QSO Party
Oct 6–7	New Mexico QSO Party
Oct 6–7	California QSO Party
Oct 13–14	RSGB 21/28 MHz Phone Contest
Oct 20–21	RSGB 7 MHz CW Contest
Oct 20–22	North Carolina QSO Party
Nov 2–5	IARS CHC/FHC/HTH QSO Party
Nov 3–4	RSBG 7 MHz Phone Contest

THIS MONTH

Four-Land QSO Party

From 1800 GMT September 8th to 0200 GMT September 10th. The same station may be worked on each band and each mode from a fixed location, repeated again if operated portable or mobile, and from each different county. Fourth call district stations work any stations. Exchange QSO number, RS(T), county and state for 4th call area, state (or province or country) for others. Fourth call area stations score 1 point for W/VE QSOs, 3 points for all others. Multiply total points x states x counties. State and country count once only. Other stations score 2 points per 4th-land QSO x 4th-land states x 4th-land counties. Count each state and county once only. Frequencies are 3575, 7060, 14075, 21090, 28090, 3940, 7260, 14343, 21360, 28600, and Novices 3700, 7100, 21100, 28100 and up. Appropriate awards. Mail logs with score no later than 0200 GMT October 10, 1973, to 4th Call District A.R.A., Attn. Bob Knapp W4OMW, R#7, Box 187, Greenville NC 27834.

Washington State QSO Party

From 2000 GMT September 15 to 0200 GMT September 17. Stations may be worked each band and each mode for contact points and more than once each band/mode if they are additional multipliers. Exchange QSO number, RS(T) and QTH (county for Washington, state, province or country for non-Washington). Washington stations score 1 point per QSO with any stations. All others score 2 points per QSO with Washington stations. Washington stations multiply total QSOs x total states, provinces and countries. All others multiply total QSO points x total of different Washington counties worked. Suggested frequencies are 3560, 7060, 14060, 21060, 28160, 3935, 7260, 14280, 21380, 28660, 3735, 7125, 21150, 28160. Appropriate awards. Logs must show dates, times in GMT, stations worked, exchanges sent and received, bands and modes used and claimed scores. Include check sheet for entries with more than 50 QSOs. Include a signed statement that the Contest Committeee's decision will be accepted as final. No logs can be returned. SASE is not required to receive a copy of the results. Mail log sheets and scores no later than October 15, 1973 to Boeing Employees' Amateur Radio Society, c/o Contest Committee, Willis D. Propst K7RSB, 18415 38th Ave. South, Seattle, Washington 98188.

Pennsylvania QSO Party

From 2300 GMT September 15 to 0200 GMT September 17, 1973. Exchange QSO number, RS(T), QTH (ARRL section for non-PA, county for PA). The same station may be worked on different bands/modes. PA stations score 3 points per out-of-state QSO, 1 point per PA QSO, multiply by total different ARRL sections worked. Non-PA stations score 1 point per PA QSO, multiply by total different PA counties worked. Activity will be around 20 kHz from top of each phone band and 72.5 kHz from low end of each CW band. Appropriate awards. Multi-op stations are counted as a separate category. Logs must show date/time in GMT, stations worked, exchanges, and band/mode. Mail logs before October 15, 1973 to Nittany Amateur Radio Club, Inc., P.O. Box 60, State College PA 16801.

VE/W Contest

From 2300 GMT September 22 to 0200 GMT September 14, 1973. Open to all hams located in the ARRL sections listed on page 6 of any QST. Only 20 hours total operating time may be used in this contest. Times on and off the air must be shown in the log. Minimum time off period allowed is 15 minutes. All bands and modes may be used. A station may be worked once per band and once per mode (CW & SSB). Phone and CW are separate contests. There are two classes of entry, single-op and multi-op. W/Ks will work VE/VO stations and vice versa, W-to-W and VE-to-VE QSOs don't count. Complete exchanges must be made before claiming QSO points or multiplier points with a given station. Exchange a 5 or 6 digit consisting of RS(T) and QSO number number (e.g., 599001 etc. on CW, 59001 etc. on SSB), and ARRL section for W/Ks, geographical areas for VE/VOs. Each completed contact is 2 points x the number of sections worked on each band (e.g., 20 QSOs in 10 sections on 14 MHz and 12 QSOs in 8 sections on 7 MHz = 20 + 12 or 32 QSOs x 2 is 64 points. Multiply this by 10 + 8 or 18 and your score is 1152 points). Appropriate awards. Logs must show band, mode, date/time in GMT, times on/off, station worked, exchanges sent and received, indication of new multipliers, and your call and section on each log page (and on the top left hand corner of your envelope). Check sheets ("dupe" sheets) are required for every entry of 200 or more QSOs. Don't forget a summary sheet with your call, section, class of operation, mode, total operating time, breakdown of total QSO points and sections on each band, final totals for all bands, claimed score, equipment used, and signed statement that all rules were obeyed and that the decision of the Contest Committee will be accepted as final. All entries become the property of the committee. Log sheets are available from the address below for a large SAE and IRCs or Canadian stamps. Mail logs before October 31, 1973 to VE/W Contest Committee, VE2IZ, P.O. Box 2206, Dorval Station 780, Quebec, Canada.

Delta QSO Party

From 2000Z Sept. 29 to 0200Z Oct. 1. Amateurs outside the Delta Division will attempt to contact as many hams inside the Delta Division (Ark-La-Miss-Tenn) as possible. Delta Division hams contact any hams. Call "CQ Delta QSO Party" on SSB, "CQ Delta" or "CQ Test" on CW. Exchange QSO number, RST, and QTH (ARRL section for non-Delta Division, county and state for Delta Division). Stations may be worked on each band/mode. Portables and mobiles may be reworked if they change counties. Suggested frequencies are 3550, 7050, 14050, 21050, 28050, 3990, 7290, 14290, 21390, 28590, 3775, 7175, 21125, 28125. Delta Division hams socre 1 point per QSO x total different ARRL Sections. Non-Delta hams score 1 point per QSO x total different Delta counties worked. Appropriate awards. Logs must include date/time, station worked, exchange, band, mode, and multiplier. Mail logs before Nov. 5, 1973 to Malcolm P. Keown W5RUB, 213 Moonmist, Vicksburg, Miss. 39180. Logs will be returned, if requested.

I'm sorry to say that the Romanian RadioAmateur Federation and the

Japan Amateur Radio League sent their contest info too late for use, but we hope to get them for you next year.

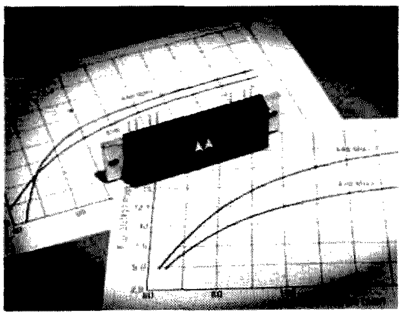
I suppose you've noticed the conflicting dates and times on some of the contests. For those of you who want to enter two contests that happen to be on the same weekend, try to divide your time equally between the two and do the best you can. I did last year, and won Ohio first place in the CA and MA QSO parties.

That's it for another month. Good luck in the upcoming contests, and I hope to see you in there adding to the chaos.

WB8KZD

NEW PRODUCTS

450 MHz AMPLIFIER MODULES

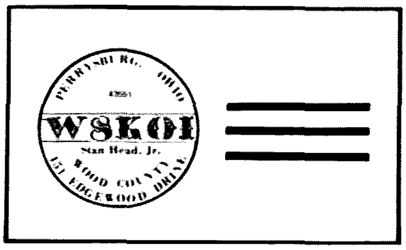


Designed for complete amplifier or driver applications at UHF, two new amplifier modules introduced by Motorola offer more than 18 dB power gain. Designated the MHW709, a 7.5W (min.), and the MHW710, a 13W (min.), UHF power modules, these are complete amplifier units capable of operation in the 450 MHz band.

Both units operate from a 12.5 volt dc supply, which is perfect for mobile installations. The MHW709 delivers 7.5W output with a driving power of approximately 100mW for a power gain of 18.8 dB. A full 13W can be produced by the MHW710 with only 150 mW of driving power for a power gain of 19.4 dB.

Harmonic suppression is at least -40 dB down across the frequency range with all spurious outputs more than 70 dB below desired signal. Input impedance is 50 ohm for both modules, and operation with a 20:1 load mismatch produces no damage to the unit. These units, when driven with a QRP 450 FM exciter, offer an extremely simple path to 3/4m operation.

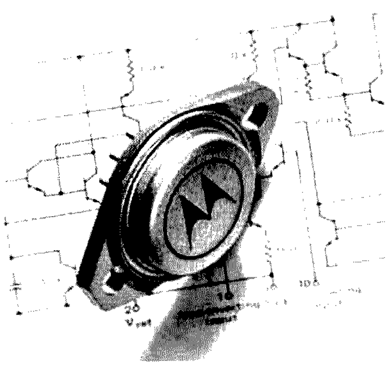
QSL CONTEST



Stan Head W8KOI wins the QSL Contest this month by beating the Post Office at its own game of postmarking the front side of nearly every QSL it handles. Take a crack at winning a free 1 yr. subscription to *73*, enter the QSL Contest, *73* Magazine, Peterborough NH 03458.

The 7.5W amplifier sells for $43, while the 13W unit runs five dollars more. For more information contact the *Technical Information Center, Motorola Inc., Semiconductor Products Division, P. O. Box 20924, Phoenix, Arizona 85036.*

10 AMP VOLTAGE REGULATOR



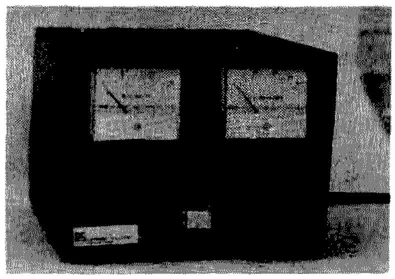
A 100W hybrid silicon voltage regulator capable of line regulation of 0.10% and load regulation of 0.15% has been introduced by Motorola. The MPC1000 is a 10-ampere positive or negative series voltage regulator capable of operating with input voltages as high was 60V. Output voltage can be adjusted from 2 to 35V to permit this single device to serve a wide range of output voltage requirements in the lab.

Output currents of 10-amperes are easily obtained from the MPC1000 without external pass transistors. Circuits using external pass transistors can expand the capability of the regulator to handle currents in excess of 50-amperes. Current limiting protection is built-in to protect the regulator from excessive surge currents.

Sample quantities are available from stock for immediate delivery, and volume orders can be filled 8 weeks after-receipt-of-order. Prices for the MPC1000 in a 9-pin metal TO-3 package are $14.95 each in 1 to 99 piece quantities.

For more information contact the *Technical Information Center, Motorola Inc., Semiconductor Products Division, P. O. Box 20924, Phoenix, Arizona 85036.*

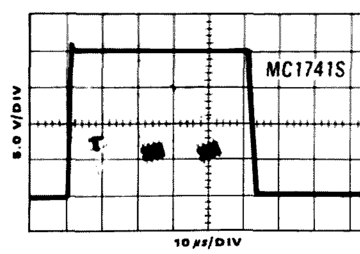
60 AMP POWER SUPPLY



Waller Electronics has a new power supply on the market that is capable of supplying a continuous current of 60 Amps at a nominal 12 Vdc. The PS 12-60 incorporates a husky constant voltage transformer which keeps the voltage between 12 and 13.6V-depending on the amount of loading. While not as precice as a solid state regulator, this system gives as much regulation as is probably needed at high current levels, while saving a bundle of money. The supply is offered in kit form for $100, but is also available completely assembled for $125. As more and more repeater groups are going all solid state, the Waller supply might be worth looking into. Even as equipment is added, this 720 Watt supply is just about all you'll ever need.

Contact*Waller Electronics, Box 9931, Chevy Chase MD 20015*

IMPROVED OP AMP



A new op amp with a minimum slew rate of 10V/µsec and a power bandwidth of 150 kHz is being offered by Motorola. It is a pin-for-pin replacement for the MC1741. Contact *Motorola Inc., Box 20942, Phoenix AR 85036.*

LETTERS

HAMS UNITE

After reading your article on "FCC Responsibilty" in July 73, I agree completely with it, but I feel a stronger appeal is necessary. If every amateur in the U.S. wrote *just one* letter to the FCC suggesting that a move be made to encourage Ham Radio rather than discourage it, that would be 250,000 letters swamping their offices! The only people who can save ham radio are the hams themselves. Complaining about rules will never change them – only a reason will. So, let's give them a reason. United we can survive, divided we will surely fall.

Robery Gray WA1JQT
Townsend MA

20-20

OK, here we go again for another 3 years. When I first subscribed to 73 it was because I was an avid (but blind!) follower of the league policy and I felt that your "mad" ravings should be monitored just to say I'd listened to both sides. Besides, the articles in 73 were good and steadily improving.

So now, it appears that all has changed. Your insane ravings of the past (hindsight is 20-20) were amazingly to-the-point and 73's articles are at the "fantastically good" level.

Ike Meissner K5CXN

ANOTHER CB MESS

I concur with you on every point on the matter of Prose Walker, as an amateur radio repeater operator and a citizen of the United States of America. Please add my name to the list of any instrument you or others can devise to rid us of Prose Walker and restore sanity to the amateur rules and regulations.

I am seldom compelled to write letters to anyone, but this situation is another story and this will not be the last letter I write about this matter.

Never before have I had contempt for the FCC, but Prose Walker may try mine and others patience down to the last thread.

His apparent contempt for amateurs and praise for the lot of uncontrollable hooligans on 11 meters does not suggest that the commision wants any operators to conform to the rules on a voluntary basis, at least not in my way of thinking.

There is no doubt in my mind that the numbers of amateurs would exceed that of the CBers if there were no technical requirements. But then what would you have? One gigantic CB mess. God help us!

Ronald Pitts WA4SGI
Burmingham ALA

6m DEAD

Docket 18803 from the FCC has resulted in virtual annihilation of an ingenious 6m communications network in this area (esp. K1IIG). To my knowledge, there was no interference with any other systems or services, and it would have been an excellent system in time of emergency.

A substantial quantity of good, used 2-way radios are now collecting dust – a true waste. 6m FM activity of any type is now 1/10 of this time last year.

John R. Haserick, Jr. W1GPO
Rockville CT

WEATHER NET?

For about 15 years I have been involved with the electrical monitoring of severe weather (specifically 10 kHz "spherics"). The monitoring technique has improved over the years and last summer I think I discovered an electrical characteristic which appears capable of locating an impending tornado. This has been discussed with knowledgeable persons with the National Oceanic and Atmospheric Administration (weather bureau). They appear interested but are presently committed to other severe weather forcasting projects. The next step necessary to investigate this characteristic involves several monitoring stations and many observers to collect data for correlation of actual weather with monitoring data. I can visualize a Ham Weather Net with several monitoring stations and observers reporting to a central plotting or analyzing location.

Ham Radio has the technical ability, the manhours, and the communication systems available to investigate this discovery. I cannot guarantee success but it would be quite a feather in the Ham Radio "hat" if we could develop a *reliable* severe weather warning system.

The simplest monitoring equipment is similar to an oscilloscope. Equipment capable of indicating the discovered characteristic is more complicated but not expensive with present IC prices. This equipment has a range of about a thousand miles so one net could handle most of the United States with a concentration in the midwest. Even without a functioning weather net, the equipment can be used for following weather fronts. It has been an interesting experience for me over the years to try to analyze weather from one location.

I would be happy to discuss this in greater detail with you or any other interested party.

Richard "Dick" Fergus W9DTW
Lombard, Ill

Developments such as this are a major reason for amateur radio to exist – so let's get cracking on your ideas. Please start with an article and a call for interested volunteers.

WHEEL INVENTED AGAIN

The dual-voltage power supply circuit, shown on page 83 of the July 1973 issue and described as a new "spin-off" from NASA, is a long way from new, having been used in commercial instruments since 1959. The attached portion of the schematic of the Branson Inst. C. "Sonoray", Ultrasonic Flaw Detector shows the circuit and the date are encircled.!

Since several thousand of these instruments have been sold and are in service today and that NASA purchased several, one wonders if the wheel has been reinvented or what?

The description by the author is somewhat misleading in that the only feature of the circuit is a means of providing a low current, higher voltage output from a conventional choke input filter. Condenser C, (Fig. 1, page 83) should be very large and the load very low so that C1 charges only on the peaks of the input wave. As the conduction period increased, C1 is effectively across the output of the full-wave rectifier for longer periods and the filter for output A assumes the characteristic of a condenser input filter, increasing the output voltage of A and degrading the voltage regulation. It is a nice trick for limited and special conditions, but you can't get something for nothing.

Elliott A. Henry, W1YUI
Newtown CN

I AGREE

When I read your column in 73 back in January I was a little bit surprised and a bit upset with the attitude and the content of your column. I couldn't understand how someone like vou could sit back and

(Continued on p. 109)

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

GONSET Communicator III 2 meters $100, Gonset 3063 2 meter power amplifier $75, package $150; Motorola P-33BAC with Ni-Cads 94/94 34/94 $125; Heath HX-20 $110, HR-20 $75, HP-20 $25, HP-10 $35, Hustler 80-10 mobile antennas mast mount $35, package $245; you pay shipping – W5PNY, 2506-A 35th St., Los Alamos, New Mexico 87544.

CLEANING TIME: National HRO-500, $1200. Drake TR-4, RV-4, AC-3, $550. Motorola HT-220, 2 watt, 2 frequency, with nicad, charger, on 94/94 and 34/94, $275. Dycomm 500D amplifier, $65. Regency TML-6, 6 channel lo-band transistorized monitor, $70. TCS surplus transmitter, $20. All excellent. Mel Stoller, K2AOQ, 373 Park Avenue, Rochester, N. Y. 14607, (716-244-2839).

GREAT CIRCLE BEARING CHARTS: Computer generated for your exact QTH. Bearings distances, return bearings for 660 worldwide locations. PRICE $1.00 postpaid worldwide. See also Ham Radio Magazine April 1973, Radio Communication November 1972. (SASE for copies of these articles.) Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

FINDLAY ANNUAL HAMFEST, Riverside Park, Findlay, Ohio – Sunday, Sept. 9 – Advance Donation Tickets $1.00 from C. Foltz W8UN, W. Hobart, Findlay, Ohio 45840.

PT-300's: P31DDN xcvr, NPN1007A Nicad Battery supply with battery, NLN6474A battery charger, with mike and all cables, 117/234 VAC, 6/12/24 VDC, and mobile mounting bracket. Have ten sets. Make offer over $150 each. Box A, 73 Magazine, Peterborough, NH 03458.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾/m	$255
Digital Logiclocks	$80
Midland 13509 220 xcvr	$200
Midland 1520 hand-held 2 meter	$190
SBE 450 450 xcvr	$340
Clegg 27B 2m xcvr	$380
Dycomm 2m repeater	$425
Standard repeater	$550
HR-6 25W	$190
Wilson 6 el. 20m beam (pick-up only)	$250
Wilson 7 el. 15m beam (pick-up only)	$250

JOBS FOR HAMS (73 will list job openings free). 73 Magazine is growing rapidly and needs dedicated hams to help with circulation and advertising. Typing skill required. Telephone experience useful. The pay is about average for the area, but – oh – the hamming we're doing up here in one of the most beautiful parts of the whole country! Ham gear is NO problem when you're working on a ham magazine. Send resume and reasons why you think you'd like to work at 73. Write to Wayne. You can play an important part in giving tens of thousands of amateurs enjoyment, helping amateur radio to grow around the world, and helping to assure its future in our country.

We are still signing on sales agents to handle 73 subscriptions and books. If you have the time and means to attend most of the activities in your area, and a personality that enables you to meet and deal with other people, you have an opportunity to turn your favorite hobby into a profitable one. One of our agents recently made over $100 for a weekend's work at a Swap & Shop Picnic. For further details write to the Circulation Department of 73 Magazine.

WESTERN UNION DESK-FAX transceiver manual: Complete theory of operation, adjustment, lubrication, preventive maintenance, troubleshooting, parts list. Includes all schematics and mechanical parts drawings. $3.80 postpaid. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

"DON AND BOB" new guaranteed buys. Discount prices plus full warranty. SBE 144 2mFM ($259.95 list) $199.95; SBE 450 TRC converts 2mFM to 3/4m. T&R ($179.95 list) $149.95; Triex MW50 tower $250.75; MW65 $331.50; W51 $386.00 FOB, Cal; W67 ($983.50 list) $834.50 FOB, Cal; Ham-M $99.00; TR44 $59.95; AR2 2R $31.95; Belden 8 wire rotor cable #8448 10¢/ft; Mosley CL36 $146.00; CL33 $124.00; TA33 $144.00; MCQ3B $91.00; S402 $143.00; MP33 $90.00; HyGain TH6DXX $139.00; 204BA $129.00; Belden 8214 RB8 Foam 17¢/ft; Motorola HEP 170 epoxy diode 2.5 A/1000 PIV 29¢ ea, $25/100; Calrad KW SWR-relative power dualmeter bridge $15.95; write specific needs, new panel meters, stock; quote discontinued tubes; Radio Master 1972 $3.50; Motorola Semiconductor Data Book series $7.50; quote Clegg FM27B; Genave GTX2; Regency HR212; Midland 13500; Standard 826MA; 146A; hardbound technical magazines, many types from Petrochemical Library $3.00/yr; Amphenol PL259 49¢; USED: Collins 75A4 $345.00; Kenwood T599 $350.00; R599 $300.00; shipping charges collect. Madison Electronics, 1508 McKinney, Houston, Texas 77002, 713-224-2668.

FOR SALE: Complete Drake 4 line, plus TC-2 and TC-6 transmitting converters. All mint. Jim Gysan, W1VYB, 617-922-3850.

WANTED: HT-32-B. Must be in excellent condition, with manual. Also a HA-2. Jim Gysan, W1VYB, 617-922-3850.

MUST SELL: GETTING MARRIED, YAESU FTDx560 under guarantee, mint condition, highest offer over $425, Dale Krohse, WWAØTUC, 444 South Western, Sioux Falls, South Dakota 57104.

AUGAT 9009 SINCS for TO36, 2/$1.50, with 2N173 or 2N441, $2.00. Anyone have some cheap ART 13 or ARO 5, prefer close. 2N173-2N441 pulls 4/$1.00, 2N2016 pulls 3/$1.00 with cross reference. SASE for list of test equipment. Trade any items for Valiant, Vikings 11, Linears, Good Receivers. Will buy if reasonable. 14 typing repert. with keyboard, $10.00. Douglas Craton, 5625 Balfrey Dr., W. Palm Beach, Florida 33406.

FOUNDATION for AMATEUR RADIO annual Hamfest Sunday 21 October 1973 at Gaithersburg Maryland Fairgrounds.

(W2NSD/1 continued from p. 84)

Is there any point in writing him – isn't it just a waste of time? Is there any way to write that will have a good chance of actually being read by him and not just thrown away by an assistant? And how can you make your point with him effectively and not just waste both of your times?

Firstly, finding out who you should write to – you can call city hall and ask them who the congressman is for your area and who your senators are. If you are in a small town you can call the town clerk.

Once you know their names you need to know where to write to them. Will you do better to get their local office address in your state or write to them in Washington? Washington is by far the best – their main office is there and they are there most of the time. The address is simple – just address it to Senator ------, Washington DC 20510. Or to Congressman -----, Washington DC 20510.

Long letters – vague letters – wandering letters – shotgun letters – all will miss their mark. These are the letters the administrative assistants handle. The letter that will get through and have an effect is the short, clear one, preferably hand written (oddly enough).

You might want to try and head off Walker on his ideas for call sign changes – on FCC type acceptance of ham gear (and probable taxation) – on power/bandwidth formulas which would greatly reduce our power limits – on crossband of repeaters – etc.

Pick your major complaint and explain it clearly and in lay terms. Explain what the problem is and what your congressman or senator can do to help.

Are You Going to Jordan?

73, in conjunction with Alia, has put together a travel package that may be of interest – particularly to amateurs. If there are enough amateurs interested, (we need a minimum of 40), we can plan on going over to see Jordan in April of 1974. The tour would be all inclusive, and would cover round trip air fare (and Alia takes you first class), hotels and all meals in Jordan, tours of the antiquities – Jarash, Petra, Irbid, Madaba, and Aqaba. Bring your bathing suit.

And don't forget a two meter hand unit, if you have one or can borrow one – you might get to work JY1! The tour also includes your JY8 call, if you have a ham ticket. You'll also be able to work the DX station at the hotel, and other club stations around the country, as well as the ham station on the 707 jet on the trip over and back.

Rather than have everyone go all at once to the antiquities, we thought it might be better to split into perhaps four groups so that about ten or twelve would go to each site at a time – with one group going up to Irbid up on the northern border – one to Jarash just north of Amman, one to Madaba, one to Petra and one to Aqaba. With the 2m intercom and the repeater it should be a blast.

There are some very nice places to shop right near the hotel, and prices are most reasonable. Wives will probably go for the hand embroidered dresses and the attractive, yet inexpensive, jewelry. They'll come home with a lot of new recipes.

We're not sure yet exactly what the dates of the flight will be, but we'll try to aim it around the first week in April. The complete price for the whole trip is $595, so if you want to get in on this super combination of a DXpedition and tour, get your reservations in soon. Write to 73, Peterborough, New Hampshire, 03458.

WAYNE

(Letters cont. from p. 106)

cut down the FCC as you did, and organization that is there to control and put to the best possible use the frequencies and bands that are given to the hams.

As time went on and as I boned up on what was going on I began to realize that you weren't just spouting hot air. I also began to realize that this organization that I thought so highly of was in fact a danger (possibly even an enemy) to me and amateur radio.

1 went back and again read your columns. I wish to thank you and your magazine for having the courage to print what you have printed warning us of the dangers and destruction that the FCC is bringing down upon us. I also hope that you will continue to write more in the future.

Sgt. W. J. Segraves WBØJDV
Korea

MORE COVER COMPLAINTS

The covers on your last six magazines have been very unacceptable. Mr. Lawrey has other magazines with acceptable covers coming into our home. These last six covers lack the good taste that the November 1972 or February 1973 had.

Mrs. Lloyd Lawrey
Kansas City MO

PETITION

The primary purpose of this letter is to send you the enclosed petition, filled out as per your July Editorial. The signatures were collected at the July meeting of the Southern Counties Amateur Radio Association; most of the signers are members; and most are users of the local repeater. In fact, the top signature is that of the repeater licensee.

You may be interested in the problems we have had with the license (which, incidentally, is actually owned by the licensee but supported to some extent by the club). The application was sent back with three things wrong:

1. We failed to exclude from the HAAT calculations those points which fell in the ocean (8 out of the 40 do so here; but on the other hand all of the admissable points are either 0, 25, 50, 75, or 100 feet).
2. We claimed a simple antenna, a ground-plane, and copied the pattern out of the handbook; unfortunately we marked the circle 0 dB instead of -1.8 dB.
3. We forgot to specify that the xmtr output power was measured with a Bird Wattmeter.

Now admittedly, these *were* errors. But in the first case and the second, all the data was there, and it seems to point up the atrocity of the regulations that allow the rejection on these grounds. As far as the wattmeter goes, it appears that the purpose here is simply to be sure that the ERP is not exceeded, and one would think that *any* measure of output (such as final tube type in a case like ours where the power is no where near the maximum would do.

So good luck with the fight. Me, I'm seriously considering writing up this mess and sending it to Jack Anderson.

Jim Hartley W2CXC
Linwood, NJ

DXPEDITION ANYONE?

I am very interested in going on a DXpedition and/or expedition to anywhere in the world. Could anyone advise me on how to find someone who would like to share an expedition with me?

Also, I am interested in employment on a sailing vessel as a mate or deck hand. I am interested in sailing the seas. I have been trying to obtain employment as a radiotelegraph operator, but it seems that the job is next to impossible to get. Does anyone know the current situation? I would be very pleased if someone could get me in touch with someone who could help me out. I can schedule on 40 and 80m CW with my Ten Tec PMI. Thanks.

Dennis Selwg WA8KKY/VE7
Alta Lake B. C. Canada

FLASHY ARTICLES

Keep up the pressure on Prose Walker!

For your reader feedback — I would like to see an article(s) on strobe lights (flashtubes — simple circuits, etc.). Must be a number of us hams who have airplanes or are building airplanes and need to make their own strobes. I am especially interested in multiple strobes, firing in sequence, etc.

Al LurieW9KCB
Peoria, Ill

FM BOOST

73 is the first magazine that really and truly boosts FM, rather than keeping it in a minor or second place. The FM advertisements, literature, news, and articles are the "most." So I just wanted to tell you to keep up the excellent work.

Stan WA2EXX
Waldwich NJ

3 + 3

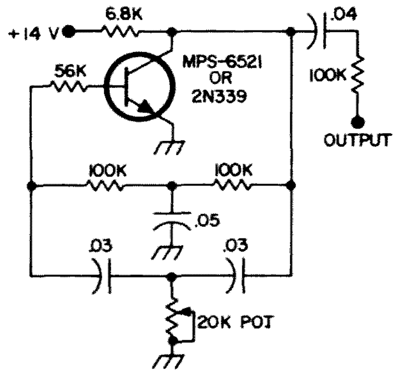
Many of the hams and CB operators down this way are using a rig called a 3+3 which is a . . . 3 to 5 watt input vfo or qrp or ssb driving a . . . 50 to 100 watt grounded grid linear which is driving a . . . 500 to 1 kw grounded linear which is driving a . . . 5 to 10 kw pep linear!

The problem is that the antenna insulators arc over. Can you run an article on this and give some points on reducing arcing while still running full power 10 kw?

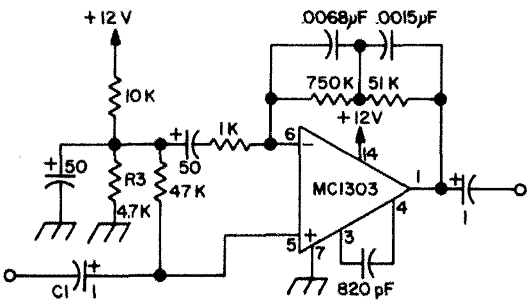
K4TXH

Yes, that has been a serious problem for many of the CB ops too and they have come up with some ingenious solutions — perhaps some readers can pass along hints which will be helpful.

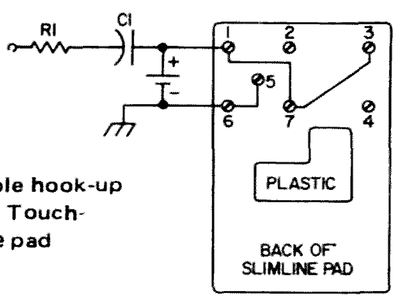
A FEW CIRCUITS . . .



A simple and stable sub-audible tone generator for PL use with FM repeaters. With miniature components it can be made postage stamp size and tucked away into any rig. For stability, mylar capacitors and film resistors are best, but carbon resistors can be sutstituted successfully. It was originally designed for 100 Hz output and the 20k potentiometer is used for adjusting this to optimum. Thanks to WB8OQC.



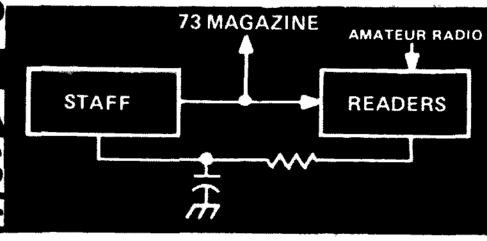
A preamplifier designed for use with a stereo magnetic phono cartridge using the MC1303. The IC is a dual device and only one half of the preamp (one channel) is shown in the schematic. Build the other half exactly the same as the first but change the following pin numbers to those in parentheses: 6(5), 5(8), 3(11), 4(10) and 1(13).



Simple hook-up for a Touch-Tone pad

Use a 1½V hearing aid battery mounted inside the slimline handset. C1 is approximately a .5–3 µF, with 1½V. I found no need for R1. Thanks to K2ZCU.

PHASE LOCK



In this issue, do you think there is a need for more

	Yes	No
Simple construction projects	☐	☐
Complex construction projects	☐	☐
General interest articles	☐	☐
Humor articles	☐	☐
Specialized columns	☐	☐
Operating news	☐	☐

Comment (a):

Comment (b):

Comment (c):

Comment (d):

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Good (Open) Fair (☐) Poor (O)

September 1973

SUN	MON	TUES	WED	THUR	FRI	SAT
						1
$\boxed{2}$	$\boxed{3}$	$\boxed{4}$	5	6	7	$\boxed{8}$
9	10	11	12	13	14	$\boxed{15}$
$\boxed{16}$	$\boxed{17}$	$\boxed{18}$	19	20	21	22
23	24	25	26	$\boxed{27}$	$\boxed{28}$	$\boxed{29}$
$\boxed{30}$						

Possible aurora 9, 10, 19, 20.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	7	3A	3A	3A	7	7	7	14	14
ARGENTINA	14	7	7B	7	7	7	14	14	14	14	21	21
AUSTRALIA	14	7A	7B	7B	7	7	7	7	7B	7B	14	14
CANAL ZONE	14	7	7	7	7	7	14	14	14	14A	21	21
ENGLAND	7	7	7	7	7	7B	14	14A	14A	14A	14	7B
HAWAII	14	7A	7B	7	7	7	7	7B	14	14	14	14
INDIA	7	7B	7B	7B	7B	7B	7A	14	7A	7	7	7
JAPAN	14	7B	7B	7B	7B	3A	7	7	7	7	7	14
MEXICO	14	7	7	7	7	3A	7	14	14	14	14A	14
PHILIPPINES	14	7B	7B	7B	7B	3B	7	7	7	7	7B	14
PUERTO RICO	7A	7	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7B	14	14	14	21	21	14A	14
U. S. S. R.	7	3	3	7	7	7B	7B	14	14	14	7B	7
WEST COAST	14	7A	7	7	7	7	7	14	14	14	14	14

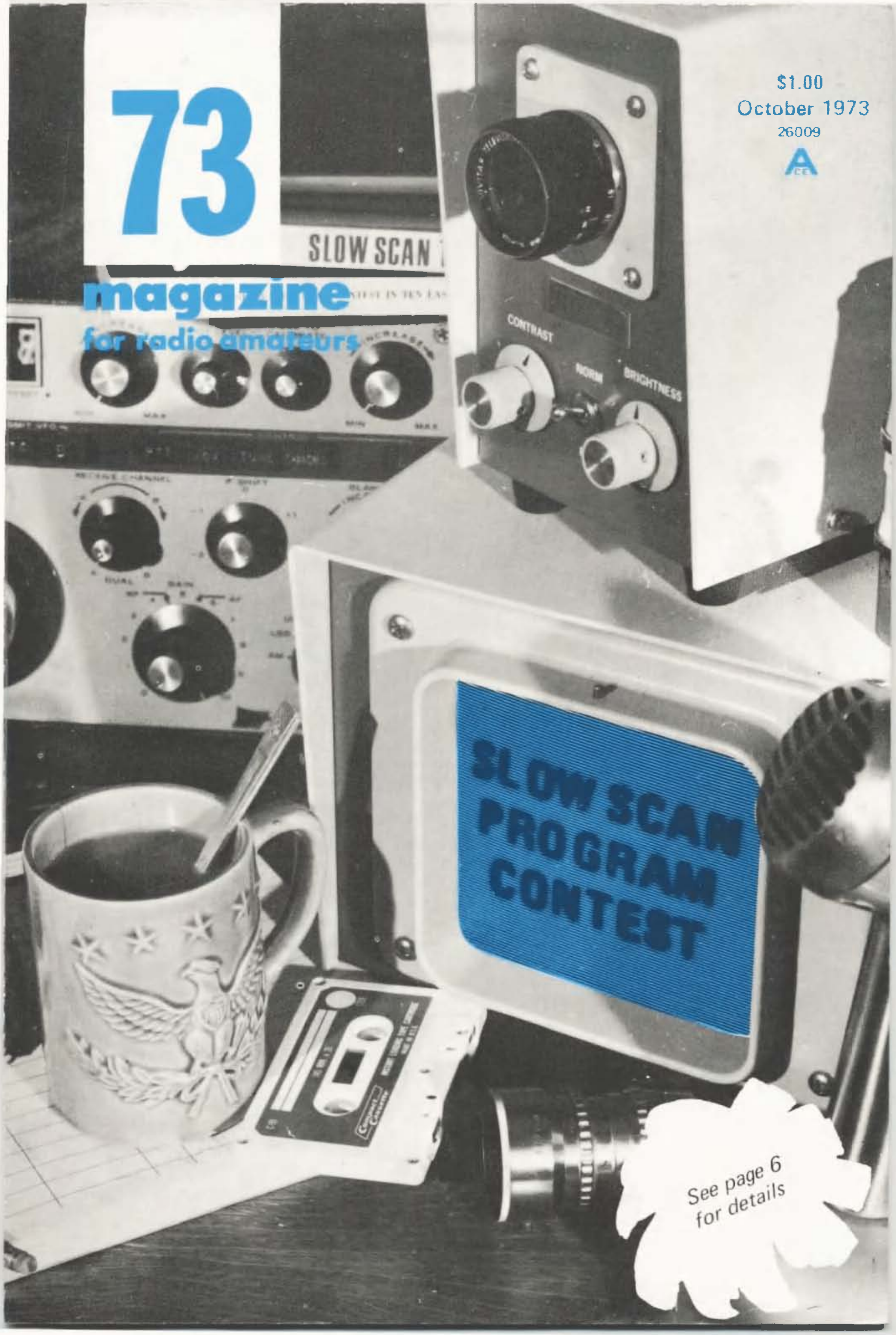
CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	7	3A	3A	3A	7	7	7A	14	14
ARGENTINA	14	7A	7B	7	7	7	7A	14	14	14	21	21
AUSTRALIA	14	14	7B	7B	7	7	7	7	7	7B	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	14	14A	21	21
ENGLAND	7	7	7	7	7	7	7B	14	14	14	14B	7B
HAWAII	14	14	7B	7	7	7	7	7B	14	14	14	14
INDIA	7	7B	7B	7B	7B	3B	7B	7B	14	7	7	7
JAPAN	14	7A	7B	7B	3B	3A	3A	7	7	7	7	14
MEXICO	14	7	7	7	7	3A	7	14	14	14	14	14
PHILIPPINES	14	7A	7B	7B	3B	3B	3	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14	14	14A
SOUTH AFRICA	7	7	7	7	7B	7B	14	14	14	14	14A	14
U. S. S. R.	7	3	3	3	3	3B	7B	7B	14	14	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	7	3A	3	3	7	7	7	7A	14
ARGENTINA	14	14	7B	7	7	7	7B	14	21	21	21	14
AUSTRALIA	21	21	14	7A	7	7	7	7	7	7B	14	14A
CANAL ZONE	14	7A	7	7	7	7	7	14	14	14A	21	21
ENGLAND	7B	7	7	7	7	3B	7B	7B	14	14	14B	7B
HAWAII	21	21	14	7A	7	7	7	7	7A	14	14	14A
INDIA	7	14	7B	7B	3B	3B	3B	7B	7	7	7	7
JAPAN	14	14	14	7B	7B	7	3A	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14A	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14	14	14A
SOUTH AFRICA	7	7	7	7	7B	3B	7B	14	14	14	14	14
U. S. S. R.	7	3B	7	7	3B	3B	3A	7	7	14	7	7
EAST COAST	14	7A	7	7	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.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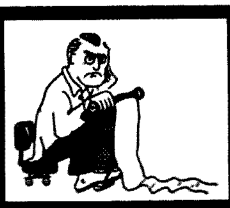
73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A. *Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.*



NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

MISQUOTED

The editor of a small DX publication – a sort of newsletter for contest ops – took me to task for the July article on the repeater regulations. Normally I would ignore something like this, but the technique is all too familiar and I would like to point this out in case someone mentions the piece to you over the air.

In this editorial I was accused of holding that it is illegal to experiment with antennas which are to be used for repeaters – that it is illegal to operate a repeater on reduced power when necessary – that it is illegal to use the same station for auxiliary link and remote control and forbidden to have more than six control operators for a repeater. Not one of these things did I say in my article – not *one*!

From there the editor proudly goes on to disprove my statements. Big deal. What I did say is on pages 59-60 of the July issue of 73 and has little resemblance to the statement by the editor. Obviously he was counting on his readers not reading my article – and he is probably right as 73 does not cover contest activity in depth and there probably is little overlap.

Since many readers do not take the time to read through things like this carefully, and thus may be confused about the above points, let me point out that it is not in any way illegal to experiment with antennas – as long as you don't do it on your repeater. Your repeater antenna must be the one that the FCC has okayed for your repeater. If you are going to change it, even for a short while, you should apply to the FCC for permission and include the horizontal and vertical patterns of the new antenna, unless it is an accepted commercial antenna, in which case you merely refer to it by its nomenclature. When you get the official word from the Commission to change, then you change. I realize that this sounds insane, but this is the way Walker wants it and the way HE reads HIS regulations – and this means that this is what we are stuck with for the time being.

It is difficult to keep up with the ever changing interpretations of the rules. Walker was adament at first that the control operator must have some system for keeping the repeater on the air with a pulse or something that would indicate that he was in active control. This seems to have been dropped – thank heavens.

Walker has not relaxed much on his position on a maximum of six control operators. This is not in the FCC rules, it is just a Walkerule, but it still has caused quite a few repeater applications to be rejected, nevertheless. Walker does say that if there are serious extenuating circumstances that he *might* accept more than six control points.

As far as operating the repeater with less than the power applied for on the license application, the Walker approach is that *any* changes in the parameters set up in the application must have official FCC sanction before being made. The repeater power obviously is one of these parameters and there is nothing in the rules about being able to operate with lower power with no notification. And Walkerules state that notification MUST be before the fact, not after, and that sanction must be received from the Commission before changes are made.

These things are all idiotic and the sooner we are able to get rid of the paperwork garbage the better. In the meanwhile the less squabbling there is in the ranks the better. The editor who backs up the FCC to the hilt like that is no real friend of amateur radio.

JOHNSON BLASTS FCC

FCC Commissioner Johnson, whose term officially ended July first, but who is serving until Nixon finds a successor, lashed out at the Commission recently in an article in the Yale Law Journal. Johnson said the FCC is "manipulated daily by the industries it is supposed to regulate and by its staff." Certainly amateurs have seen that happening in recent months, with the deluge of new Walkerules and the 224 MHz CB band that seems to be wanted by only the Electronics Industry Association – the Washington lobby for the CB industry. Money talks.

"As a result," Johnson continued, "the commissioners often make precedents which return to haunt them." Like the 27 MHz CB band, perhaps.

NASA NIXES HT

With a bonafide ham aboard the next to the last Skylab trip, it seemed a natural to have him pack along a little hand unit for some two meter FM work. The space and weight were no problem – but the politics was.

Owen W5LFL was already in the clean room a few days before departure when K3GKB managed to get a little four channel hand unit through to him via Owen's wife – only to have NASA officials turn thumbs down on the basis that they didn't want to have any possibility of anything being said from Skylab that they couldn't censor before release.

Some amateurs have gotten reprimands from NASA for tuning in the down link and giving the information to news media or letting it go through local radio stations. NASA wants complete control over everything coming from space.

Pity.

Imagine the pileups on 34/94! And 52/52! Plus he had one 147 MHz channel set up for simplex that Clegg users would be able to jump on right away.

Pity.

REPORTS NEEDED

Though radio amateurs are intimately involved in virtually every serious disaster, not one in a hundred are written up and sent in for us to use in the newspages or in our letters to congress. Please give us the news to use for these valuable services.

Most ops who get involved in emergency work put their all into it and then figure that once the job is done the job is done. There is still a responsibility to help amateur radio by making known what has happened so you can reconstruct the story later and know that you have it straight.

While only 73 and QST are into this type of news, I can assure you that both of these magazines will appreciate knowing what has happened. 73 gives you the extra advantage of knowing that your story has a good chance of being told to congress – and might get into the Congressional Record.

FCC HEARING

Plans are well along for a public hearing before the FCC Commissioners en banc on the matter of the FM repeater rules. The hearing seems to be coming as a response by the FCC to the 73 editorials and pressure to re-examine docket 18803. The en banc hearing was suggested by FCC Chairman Dean Burch in a phone call to 73.

A position paper is in the works which will explain the problems with the new rules, why these rules present

problems, and what amateurs recommend be done to improve the rules. This paper will be provided to the Commissioners and other interested parties (Walker?) before the hearing.

Representatives of many of the major repeater groups will participate in the hearing. Since time will be very limited, this will probably be kept down to perhaps a dozen at the most. Every effort will be made to have intelligent, well informed and erudite men to answer for all of us at the hearing. The last thing we need is some egomaniac taking the floor to create a bad impression and waste the whole hearing for us. . .and, as you may realize, amateur radio has more than its share of these critters.

The ARRL was granted a hearing by the Commissioners on July 9th and the reports are that they created a favorable impression with their presentation of the good aspects of amateur radio. Unfortunately they apparently did not get around to explaining why amateurs are so uptight with Walker about the new rules — so this job is still ahead of us.

It is hoped that the result of this hearing will be a re-writing of the repeater regulations. There are many of them that are in bad need of elimination or serious change. Considering the degree of self-regulation of amateur repeaters, it would seem beneficial to have all of the antenna restrictions removed, power limitations removed, crossband restrictions removed, control restrictions removed, map coordinates and height calculations removed, block diagram requirements removed, band limitations removed, power calculations and antenna pattern requirements removed, multiple repeater interconnection restrictions removed — and things like that.

Amateurs, based upon their fantastic record of achievement and service, deserve to be set free to experiment and develop in whatever way they desire.

Once we are able to back Walker down on his Walkerules and Walker-interpretations, perhaps we can get to work on bringing other recent rulings into line — such as the third party traffic restrictions. The FCC handed out a notice of violation to an amateur in a drive-in theater who revealed the price of admission to someone on their way to the drive-in! This insanity has to stop too! The original rules prohibit pecuniary interest and perhaps that is where it should stop. If a chap in Bolivia wants to know where the devil his antenna rotor he ordered from an outfit in New York is, we should be able to call in for him and find out. The fact is that Ma Bell makes out just fine with most phone patches and darned few ham messages cut into any possible phone revenue. Ma is doing very well anyway, and her major problem is in keeping up with service, not trying to hog it.

We'll try and bring a full report on the FCC hearing — hopefully with some good news on possible rule changes.

Repeater councils that are interested in helping support this hearing should immediately prepare a paper outlining the rules that should be changed — why they should be changed and how they should be changed. Councils who have provided this paper have a right to send a representative to the hearing. Please send the paper to 73 Magazine — and let us know who your representative might be and how to get in touch with him (or her?).

In answer to the editors and amateur radio officials, elected and self-appointed, who took the time and trouble to point out that there was no use in complaining about the repeater regulations — that nothing could be done — that a petition was a waste of time — that we should all just depend upon the League — I would like you to realize that it is indeed possible for someone in our country to speak up and be heard. It is possible for someone to get action. It may even turn out to be possible for rules to get changed!

In this case it was Wayne Green that made the outcry — but it could just as easily have been any individual concerned amateur. Space is available in 73 — and possibly elsewhere for this sort of thing. If you speak up 73 will back you up.

IBM TAPES NEEDED

The tapes for the 73 Magazine MTST IBM composer are wearing out and we need more. Does any reader know where we can get some for a reasonable price? Help!

73 AGENT DOES WELL

One 73 agent made over $300 at a hamfest in commissions — perhaps you might look into this? That's not a bad pay for a day's work, you know. Drop a note to 73 Magazine and send some references.

DAYTON EXPANDS — AT LAST!

The Hamvention committe has at last decided to expand the Hamvention to a full two and a half days. Thousands of amateurs will certainly cheer this decision — as will an awful lot of manufacturers.

Any amateur with more than one or two interests in the hobby has had a heck of a time getting to the talks of importance. With all of the talks scheduled in one day, there was incredible overlap. DXers missed important RTTY meetings — delightful SSTV meetings — and so forth. With over two full days for meetings and talks, these things may be able to be spread out a little better.

The size of the flea market has been such that no serious scrounger could possibly do it justice in one short day — there was just far too much.

And the manufacturers exhibits were so packed with hams that only about one in five Hamventioneers could break through to ask a question. The odds should be a little better next year. This will be better for the manufacturers too — for they will have a chance to talk personally with more prospective customers — and make more sales — the basic reason for the long trip to Dayton.

The largest hamfest in the country can only get larger with this move.

CASSETTE TAPE CODE COURSE

73 is offering a cassette tape code course that is so simple that the average person can learn the code fast enough to pass the Novice or Tech exam in a few hours. One of the beauties of cassette tapes is that you can take them with you anywhere — at work for lunch break — in the car while you are driving — cassette recorders are simple and inexpensive — and are useful for dozens of ham applications.

This cassette code course will teach the International Morse code at five words per minute — all letters, numbers and punctuation. The tape not only gives all of these characters, but gives them in a very simple order so you can start copying code within one minute of hearing it. This has got to be the easiest way to learn the code ever invented.

The cassette actually has the code being sent at about 6 wpm, allowing a margin for operator panic when the chips are down and the real exam is at hand. It makes the 5 wpm code sound a whole lot slower — and that is a help.

And wait'll you get a look at some of the stuff you'll be copying on this tape — pure Wayne Green, of course. You may lose your place the first time through when some of the stuff hits you. There's no reason why copying code shouldn't be fun — right?

Send now for the 73 Morse Cassette Code Course — only $3.95 postpaid from 73.

WAYNE

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

SSTV CONTEST ANNOUNCED

This winter promises high Slow Scan activity, and we're kicking it off with a *Slow Scan Program Contest.* It works like this: Make up your prize winning program (6 minutes maximum) on a cassette, and send your entry to 73 Magazine. They will be compiled and reviewed, then forwarded to another "anonymous" judge to be reviewed again. Final results and prize winners will be published. Selected frames from winning tapes will also find a prominent place in these pages.

All entries will be judged on originality, with technical aspects counting in the scoring. This contest begins *now* and ends December 31, 1973. Be sure to include return postage for your tape.

The purpose of this contest is to get more fellows thinking and acting in terms of good purposeful programs, not just IDs and CQs.

Last month I briefly described some basic scan conversion techniques from the aspect of both solid state and dual gun (lithocon) electron tubes. I also mentioned Don W9NTP, and Art SM0BUO, were developing a converter unit that used the Thompson TME 1238, a single gun storage tube. Since this tube is rather unique, (only one electron gun is used) I have a brief description this month. Figure 1 is a simplified sketch of the tube. First the Slow Scan video is fed in on Grid 1, and stored on the mosaic target. Next, Grid 1 (writing grid) is biased to give a constant electrong flow. The electrons now repelled by the "reading" Grid 5, and can be fed to a video amplifier. Since the reading grid does not affect the target (because it doesn't scan it) it is considered a nondestructive readout device. In fact, Don turned on his unit two weeks after the Dayton Demonstration, and his last picture was still there! (Of course it wouldn't last this long if it had been constantly "read.")

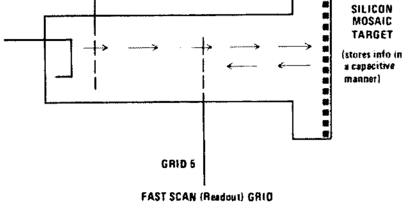


Fig. 1. Simplified sketch of a single-gun storage tube.

Our thanks to Dr. Miller for the previous info on the Thompson CSF tube. I understand Don replaced the bad video transistor that caused the noisy pictures at Dayton, and now the unit is working well. Incidentally Don agrees, like many others, digital processing is probably the better way to approach scan conversion from a "standstill." In fact, 3 MOS shift registers, driven by red, green, and blue Slow Scan information could be used to give Slow Scan displayed on a color Fast Scan TV in real time. This is probably 2 or 3 years away yet. A couple of the fellows suggested this MOS shift register method over my "crt/dichroic mirror" color scheme, and I agree this is better. However, for the next few years, the tubes and dichroic mirrors (advertized in the July issue for $4.95 each) should be less expensive.

Here's some more info on the weather satellite I mentioned last month whose facsimile transmissions might be of interest to Slow Scanners. At this time the four main satellites of interest are ESSA-8 (137.62 MHz), NOAA-2 (137.50 MHz), ATS-1 and ATS-3 (both on 135.60 MHz). ESSA-8 and NOAA-2 are orbital satellites, with an orbital period of 114 minutes, inclination of 101 degrees, and an altitude of 906 miles. (Orbital info is given on W1AW bulletins.) ESSA-8 transmits only while the spacecraft is in daylight areas, and cuts off when it enters a dark area. NOAA-2 is said to be transmitting continuously. ATS-1 and ATS-3 are fixed position (geosynchronous) satellites. ATS-1 is approximately 4,000 miles above Venezuela (70° West/0° latitude). Both of these satellites scan (and can be received by) about 1/3 of the world. You can get a rough idea of this coverage by placing an object 4,000 scale miles above Venezuela on a world globe, for example. Then look at the globe from that point, and you'll see what the satellite sees. If it's "line of sight" (use a piece of string from your QTH to satellite) you should be able to receive it. ATS-1 transmits daily at 0130 to 0215 GMT, and again at 1400 to 1445 GMT. ATS-3 transmits daily at 0730 to 0815 GMT and again at 2045 to 2130 GMT. All of these satellites (except NOAA-2) transmit primarily on facsimile using an amplitude modulated 2400 Hz tone. Maximum amplitude (80 to 100%) corresponds to white, and minimum amplitude (30 db below this) is black. The horizontal line rate is 4 per second, (240 lines per minute) and a total frame lasts approximately 208 seconds. NOAA-2 differs only in that it has a 48 line per minute rate.

For satellite copy on a surplus deskfax unit, simple video inversion is necessary. (Because maximum amplitude gives the darkest line on current sensitive fax paper.) Then we increase the drum speed from 180 rpm to 240 rpm. There are several methods of accomplishing this like, for example, dividing the 2400 Hz received signal by 30 and using this resultant 80 Hz to run the motor, thus giving 240 rpm. Another method of copying pictures from the satellites is with a converter (for obtaining proper horizontal and vertical timing, a video demod/amplifier, and "front end" limiter) feeding a 'scope or Slow Scan monitor. A camera is then used to photograph the screen (three minute picture. . .strictly Sloooow Scan!), thus reproducing the picture. Special thanks go to Bob WA7MOV, for his help in compiling much of the above info. I've also received word from R. L. Drake's Service Manager. Their 2 meter gear should receive okay on 136 MHz, although they have not tried it. Possibly the 2 meter rig's crystal oscillator coil may need slight retuning. (Why shouldn't it work. Many put crystals in 2 meter rigs to pick up Police calls on 150 to 160 MHz.) Mr. Frost of R. L. Drake says crystals are $7.50 each for the TR-22 and are not returnable. Also the TR-22 bandwidth is 20 kHz. . .fine for satellite copy. Say — how about a Bearcat "scanner" set up to copy all the satellites.

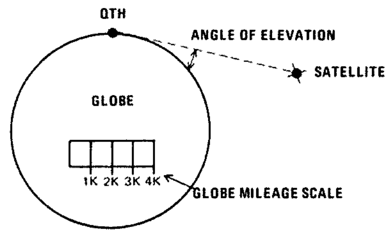


Fig. 2. Setup for measuring satellite antenna positioning.

Barry VK5BS, recently vacationed in the Fiji Islands, carrying quite a bit of SSTV info in hopes of getting some of their hams on slow scan. (Two packs of info I sent him arrived just a couple of days before his departure!) Hopefully, we will soon know the status of SSTV in Fiji.

And finally, the Independent Sideband boys are gathering on Tuesday nights between 14.230 and .240 kHz for ISB SSTV operations. If you're interested, here is the place to be to get in on the action.

. . .K4TWJ

DX FOOTNOTES

Gus Browning W4BPD
Drawer "DX"
Cordova, SC 29039

SOME QSL INFO:

A26AC via	4S7YL
AP2MR via	Callbook address
C29ED via	VK3TL
CT2AZ via	WØ JHY
EL7D via	DK3IA
ELØ Q via	LA9GG
ELØ S via	YU3RCZ
ET3USD via	WA4HVQ
FØ ALN via	K4II
FB8ZB via	F8US
GC5AGA via	K4II
HBØ AVB via	DK3ST
HW3UIT via	F9OE
JW4EJ via	SM5BCS
JW7FD via	LA3UC
JX6VO via	LA1RQ
JX9TM via	LA9TM
SVØ WY via	WAØ VPX
M1C/D via	I4FTU
TJ1BG via	K4WQS
TY7ABM via	DL7JJK
WI9ANG via	WA9DZL
WF2OC via	W2HAQ
WS4SKY via	WA3NAN
3D2JA via	W2OVC
5Z4KL via	GM3VLB
7W3ITU via	7X-buro
9X5MV via	DJ2AZ

If you want to see more DX QSL info each month let me know because I can give you a lot more than the above.

WTW VERIFICATION POINT:

I wish to announce that we have a FB DX Club that has volunteered to act as our WTW (and 73-73-73, too) verification point for all of W/K1, W/K2, W/K3 land. More or less centrally located too:

The Thomas A. Edison Amateur Radio Assn.
c/o WB2FVO Club QSL Manager
William W. Inkrote, Jr.
52 Elliot Place
Edison, N.J. 08817 - U.S.A.

Be sure to send them all your cards to be checked. Send along the $ 1.00 to help the expenses for your certificate, and also send along enough extra for the class of postage to return your cards to you. They will give you very fast service I am sure - I will mail you the certificate that you qualify for when they notify me that your cards have been checked and that you have qualified O.K.

We still need more verification checkpoints. how about your club ? I am at last getting things fixed up here and will be seeing all of you on or near 14220 sometime between about 2200 to 2400z. 73 till next month - de, Gus B P D

SOCIAL EVENTS

RATARAMA

The Mount Airy VHF Radio Club, Inc., presents the annual Pack Rat Hamarama, Sunday October 7, 1973, at the Warwick Fire Co., Jamison, Pa. The Warwick Fire Co., is located on Rt. 263 North of Philadelphia. Activities include a giant flea market, auction, and an amateur TV demonstration. Festivities begin at 10 AM. Food concession on premises. Registration is $1.00, flea market tables or tailgate sales, $2.00. Talk in on 146.52 and 52.525. For furthern information contact: Dave Zimmerman W3ZD, 520 Centennial Rd., Warminster PA 18974.

MIDWEST CONVENTION

The ARRL Mid-West Convention is being sponsored by the Lincoln Amateur Radio Club this year. It will be held on October 6 and 7, 1973, at the Villager Motel and Convention Center in Lincoln, Nebraska. It promises to be one of the largest in the Mid-West, drawing on radio amateurs in a four state area and more. For information contact: G3UGH/WØ. c/o Lincoln Amateur Radio Club, Inc., P. O. Box 5006, Lincoln, Nebraska, 68505.

MID-SOUTH HAMFEST

The Mid-South ARA is holding its 1973 Hamfest on October 6 and 7, at the State Technical Institute in Memphis TN. There will be a MARS meeting, FM Symposiums and other activities. Contact: Harry Simpson W4SCF, c/o Mid-South ARA, 1830 Macaulay Ave., Memphis TN 38127.

CHAUTAUQUA AUQTION

The Chautauqua County NY FM Association's third annual auction will be held October 13, 1973, at Shore Acres Boat Yard, Bemus Point NY. For further information write to Robert Greenwald WB2YQO, Rte. 2, Box 76, Jamestown NY 14701.

OCTOBER REPEAT

A special meeting of the Illinois Repeater Council will be held on Saturday, October 20, at Southern Illinois University. Hosted by WR9ABU, all Illinois and adjacent repeater representatives are cordially invited. Contact: Kontact Kim King, Sec. IRC, 1618 Linden, Des Plains IL 60018, 312-824-8419

TAMPA BAY

Seven Tampa Bay Area clubs have joined forces to present, perhaps, the largest ham gathering in the State of Florida. Over $2500 worth of prizes will be awarded by drawings. First prize will be a complete Galaxy 500 station. Registration is $2. It will be held on October 6 and 7, 1973, at the Electrical Building, Florida State Fairground on N. Boulevard, 2 blocks north of Kennedy Boulevard, beginning at 8 AM local time. Inquiries may be sent to Mr. George Dixon WA4VQT, 12915 Veronica Ave., Tampa FL 33612. In addition, we are providing an information station on the air Monday, Wednesday and Friday, 7 – 7:30 PM EST and Sunday, 10 – 10:30 AM on 7280 kHz.

ADRIAN HAMFEST

The Adrian Amateur Radio Club Inc, of Adrian Michigan, presents their fall Hamfest, Sunday October 14, 1973, from 8 AM to 3 PM, at the Lenawee County Fairgrounds on Dean St. Talk in on 1812 kHz – 3935 kHz – 52.525 MHz – 146.46 MHz – 146.52 MHz – and 146.94 MHz.

All buyers, sellers and visitors are welcome. Plenty of refreshments and prizes. Cost $1.00 in Advance, $1.50 at the gate. Tables $1.50 per half table. For information on tickets or tables write to the Adrian Amateur Radio Club, P. O. Box 26, Adrian MI 49221.

FAR-OUTing

The Foundation For Amteur Radio will hold its annual Hamfest at the Gaithersburg Fairgrounds, Gaithersburg MD, on Sunday October 21, 1973. Featured is a large flea market, food service, exhibits, ladies events, supervised children's program and many prizes. Main events are all indoors. Picnic grounds and free parking available. Will be held rain or shine. Participation fee $1.50, sales space $5.00. Talk-in service provided. Nearby motel rooms available. For info write or call Bill Miller K4MM, 10919 Woodfair Rd., Fairfax Station VA 22039. 703-893-2450.

TERRY SWAP

The Terry County Amateur Radio Club's 19th Annual Brownfield Free Swapfest will be held on October 14, 1973 in the National Guard Armory, Brownfield, Texas. Doors open at 6:30 AM and Swapfest activities last until 3:00 PM. No registration or admission fees! Door prizes. Largest Amateur Radio flea market in Texas! All exhibitors, amateurs, CBers and families welcome. Free parking and trailer camping in Coleman Park adjacent to the Armory.

REPEATER UPDATE

LISTENING
94 76 88 73 70 64 82. . .

AL	WR4ACK	Decatur		146.40-147.00
AL	WR4ACB	Birmingham		146.16-146.76
				146.13-146.76
CA	WR6ACB	La Habra Hts.		146.10-146.70
CA	WR6ABX	Woodland		146.37-146.97
CT	WR1ABA	Simsbury		146.22-146.82
CT	WR1ABC	Torrington		223.06-224.66
FL	WR4ACV	Boca Raton		146.22-146.82
IA	WR0ABS	Davenport		146.22-146.82
IL	WR9ABX	Rock Island		146.34-146.94
IN	WR9A6P	Indianapolis		146.16-148.76
IN	WR9ABW	Kokomo		146.31-146.91
KS	WR0ABO	Pittsburg		146.13-146.73
KY	WR4ACO	Ashland		146.34-146.94
MA	WR1ABO	Worcester		146.37-146.97
MA	WR1ABV	Weltham		146.04-146.64
MA	WR1ABK	Foxboro		146.31-146.91
MD	WR3ABO	Harmam	PL	443.95-448.95
MO	WR0ABC	Bonne Terre		146.28-146.88
NY	WR2ABF	Rochester		146.19-146.79
OH	WR8ABA	Mt. Vernon		146.19-146.79
OH	WR8ABC	Cleveland		146.16-146.76
OH	WR8ABF	Dayton		146.34-146.94
OH	WR8ABG	Springfield		146.13-146.73
OH	WR8ABH	Hodson		146.01-146.61
OH	WR8ABJ	Newcomerstown		146.16-146.76
OH	WR8ABO	Chillicothe		146.25-146.85
OH	WR8ABP	Cincinnati		146.28-146.88
OH	WR8ABK	Delaware		146.37-146.97
OR	WR7ABJ	Westport		146.16-146.70
PA	WR3ABF	Valley Forge		Planned
PA	WR3ABG	Valley Forge		Planned
PA	WR3ABH	Valley Forge		222.34-223.94
PA	WR3ABI	Valley Forge		148.34-146.94
TX	WR5ABM	Brownfield		146.22-146.92
VA	WR4ACW	Richmond		146.28-146.88
WI	WR9ABV	Lake Geneva		146.37-146.97
WI	WR0ABS	Milwaukee		146.25-146.85

CONTESTS

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

Sept. 29-Oct. 1	Delta QSO Party
Oct. 6-7	New Mexico QSO Party
Oct. 6-8	California QSO Party
Oct. 13-14	RSGB 21/28 MHz Telephony Contest
Oct. 20-21	RSGB 7 MHz CW Contest
Oct. 20-22	North Carolina QSO Party
Nov. 2-5	CHC/FHC/HTH QSO Party
Nov. 3-4	RSGB 7 MHz Phone Contest
Nov. 5-11	QRPP CW QSO Party

This Month
New Mexico QSO Party

From 220 GMT October 6 to 0100 GMT October 7; 0200 GMT to 0600 GMT and 1800 GMT to 2200 GMT October 7, 1973. Frequencies are 65 kHz up from the bottom of each CW band, phone near the edge between General and Advanced frequencies, Novice near the middle of each Novice band. Only NM stations call CQ Contest near these frequencies. Exchange QSO number, RS/T and QTH (county for NM, state, province or country for others). Stations may be contacted only once on each band, and again if he changes counties. Intrastate NM contacts are valid. Score 1 point per QSO. NM multiplier is total states, provinces, countries and NM counties. Non-NM use total NM counties for multiplier. Appropriate awards. Full log data, including exchanges, should be sent to Bill Wageman, K5MAT, 35 San Juan, Los Alamos NM 87544 by November 1, 1973.

California QSO Party

From 1800 GMT October 6 to 0600 GMT October 7, and 1500 GMT October 7 to 0300 GMT Octber 8. Same station may be worked once per band/mode. Exchange QSO number, RS/T and QTH (county for California, ARRL section or DX country for others). California stations work anyone. Non-California work California only. Score 1 point per QSO. Multiply total QSO points by total California counties worked or total ARRL sections (including California) and DX countries worked. Frequencies are 3560, 7060, 14060, 21060, 28060, 3880, 3980, 7280, 14280, 21280, 21380, 28580, 3725, 7125, 21125, 28125. Appropriate awards. Logs must show date, time, band, mode, exchanges sent and received. Logs can't be returned. Be sure your call is on each page. A summary sheet is required showing counties, ARRL sections and DX countries worked, breakdown of QSOs per band and scoring. Include your name, call and address in large block letters. Mail logs before November 7, 1973, to John Minke, W6KYA, 6230 Rio Bonito Drive, Carmichael, California 95608. Include a large SAS for results. Comments are encouraged and appreciated.

North Carolina QSO Party

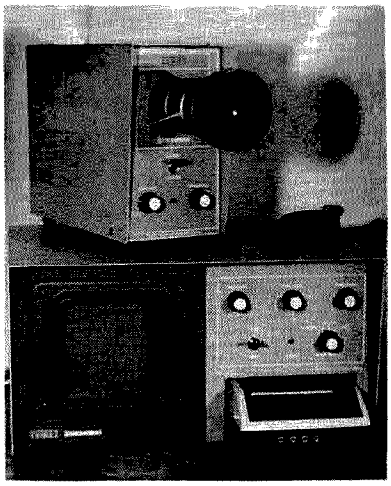
From 1800 GMT October 20 to 0600 GMT October 21 and from 1300 GMT October 21 to 0200 GMT October 22, 1973. Each station may be worked once per band/mode and again if operated portable or mobile, and with each county change. Exchange QSO NR, RS/T and QTH (county for NC; state, province or country for others). NC score 2 points for out of state QSOs, 1 point for QSOs with other NC stations, multiply total points by number of states and provinces worked. Out of staters score 2 points per QSO and multiply total by number of NC counties. Frequencies are 3575, 7090, 14070, 21090, 28090, 3710, 7110, 21110, 28110, 3810/3900, 7290, 14290, 21310, 28510 (all are plus/minus 10 kHz). While on 3575 try not to QRM the Carolina's traffic net which meets at 2300 GMT and 0200 GMT near that frequency. The entire 6 and 2 meter bands can be used, and repeater QSOs count. Appropriate awards. Mail logs before November 25, 1973 to Charlie Wells, K4SKI, Rte 8, Box 414, Greenville NC 27834.

By the shadow on the wall I see that it's time to wrap up another column. Until next time, "CQ Contest, CQ Contest, CQ Contest."

Tom WB8KZD

NEW PRODUCTS

SBE Scanvision



The W2NSD/1 Scanvision package being tested with special zoom lens.

SBE has come up with a beautiful slow scan system — complete with a built in cassette tape recorder. This system makes it duck soup to put together your own tape programs. . .and let's face it, this is the way slow scan has gone.

With tape reproduction of a slow scan usually identical with "live" camera work, it is only logical that most ops have opted for using tape. It doesn't take long sitting still for eight seconds in front of the camera — and then jumping up to refocus (which isn't all that fast a process unless you have a fast scan monitor too) on a menu board for giving your name, location, signal report, and perhaps a QSL — before you are thinking seriously in terms of tape. Unfortunately, many of the cheaper recorders are not adequate for the job

and there are little squiggles which result from not too steady tape drive mechanism.

Once you are set up with a good recorder you can start putting together short tape programs — a view of your shack — picture of you — your wife — with titles. You can tape the QTH and CQ calls. You can work up a short program showing some of your other interests than amateur radio — which is not only interesting to viewers, but affords plenty to talk about if you match an interest with someone else.

You can put together a program of your QSLs for each country worked, unless you are one of the real slow scan DXers with 73 countries worked, in which case it would take about ten minutes at one card per frame, to show the bunch. Even so, that might be a little better than some of the dumb cartoons that are being shown.

The SBE Scanvision camera has one very handy feature — an automatic contrast control. The less controls you have to diddle with the better. There is a manual over-ride for knob twisters.

After using the Scanvision for several weeks, there are several things that stand out — the ease of hooking it up for use — the beautifully sharp picture — the convenience of the built in tape deck — and (most of all) the fun of actually seeing the fellow you are working.

The Scanvision manufacturer also makes commercial broadcast television cameras and this is obvious when you open the camera and take a look at the construction techniques. . .beautiful! This shows up in the picture too — just take a look at a grey scale on this monitor and see how much more you get than you might expect.

Linear Systems is to be congratulated for making this superb slow scan unit available — slow scan will, it seems certain now, be one of the big growth aspects of amateur radio during the next few years. Once you see it in action you are hooked.

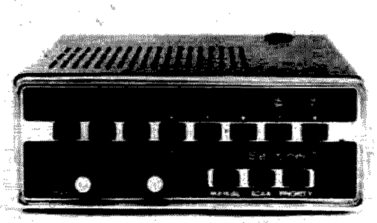
TONE PADS

Interface Technology has introduced a Touch-Tone generator designed to aid repeater and autopatch users. The unit generates the 12 standard frequency pairs used for Touch-Tone dialing by the telephone companies. It is designed so that the output can be used in several ways. For one, a speaker included in the kit can be mounted internally and the unit simply held up to the microphone. The speaker can also be mounted in a small, remote case (not

supplied) and connected by a cable to the generator. This allows the user to position the generator on a table or desk while the speaker is held up to the microphone. A third approach is to wire the unit directly into the microphone circuit, eliminating the need for the speaker altogether.

There are no switches or controls on the unit other than the key pad, so no current is drawn from the standard 9-volt transistor battery until the operator touches a key to generate a tone. This feature insures long battery life and simplicity of use. The unit is lightweight and packaged in an attractive black molded plastic case. For more information contact: *Interface Technology, Inc., 10500 Kahlmeyer Dr., St. Louis, Missouri, 63132. 314-426-6880*

SBE SCANNERS

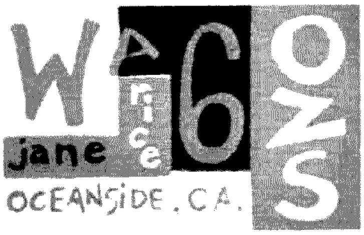


Linear Systems has announced the introduction of a complete line of scanners which cover frequencies from 30-470 MHz. The entire line, known as the Sentinel Series, consists of six separate models.

The Sentinel includes 8 channels for scanning, lock-out switches, manual or automatic scan operation and AC/DC capability. An important feature of the Sentinels is the priority channel which assures the reception of the most important channel. All come equipped with cord/plu sets for either 12V dc or 115V ac operation. Also included is a screw-in telescoping antenna for VHF and where applicable a separate VHF plug-in antenna. The receivers have excellent sensitivity of $.3\mu V$ with selectivity rateo at -6db @ 9 kHz. Audio output is 4 watts and the receivers are designed to operate over the temperature range of -20°C to +50°C. The specific model numbers and frequency ranges are Sentinel I high-low VHF, Sentinel II high band VHF, Sentinel III low band VHF, Sentinel V UHF, Sentinel VI UHF high band, and Sentinel VII marine VHF.

For further information contact: *David K. Bradley, Vice President, Marketing, Linear Systems, Inc., 220 Airport Boulevard, Watsonville CA. Telephone: 408-722-4177.*

QSL CONTEST



Jane Rice WA6OZS, captured the heart of our contest judge this month with her homebrew silkscreened entry. Win a one year subscription to 73! Send your QSL to: QSL Contest, 73 Magazine, Peterborough NH 03458.

CANADIAN GOVT. SUPPORTS REPEATER GROUP WITH GRANT

$6,772 AWARDED

State-of-the-art thinking on the part of Canada's Department of National Health and Welfare has prompted a $6,772 grant to a repeater group in Courtenay, B.C. Realizing the importance of VHF repeaters in providing emergency communications during times of disaster, the grant was endorsed whole-heartedly by civil defense authorities. The planned repeater will provide communications within a 150 mile radius.

Meanwhile, back at the FCC. . .

Caveat Emptor?

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WESTERN UNION DESK-FAX transceiver manual: Complete theory of operation, adjustment, lubrication, preventive maintenance, troubleshooting, parts list. Includes all schematics and mechanical parts drawings. $3.80 postpaid. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

"**WANT VIBROPLEX** carrying case. Advise condition, age and price. P. O. Box 191, Rye Beach NH 03871."

2 METER FM Brand new HR-2A 94/94, 22/82, Hustler 5/8 trunk lip, warranty, perfect. WA6LZH, 4130 Carson, Oakland CA 94619, 415-530-7187.

COLLINS MP-1 Power Supply, new never used, trade for 516F2, PM-2, 312B4, HT220, or ST-6. Want to buy 32S1. Fred Slaughter, WB8IJX, 3636 Douglas, Toledo, Ohio, 43613.

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FOR SALE: GE Porta-Mobile 2m, 10 watt portable with nicad, 94/94, 22/82, $300. HT-220, two watt, two channel with charger, $275. MOTRAC "A" model transmitter and power supply, $35. MOTOROLA pocket-receiver with nicad, $45. MIDLAND CB? – $25. Gary Eberle, WA6CW, 1655 Via Escondido, San Lorenzo, CA 94580.

WANTED: Facsimile equipment, weather satellite equipment and/or information, RTTY machines 100 wpm. Ken DeBrecht, WB6NOV, P. O. Box 1086, Novato CA 94947.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only.

Cap-Com 40m solid state SSB xcvr	$150
Heath IB-101 counter with Vanguard Scaler	$250
Clegg 27B 2m xcvr	$380
IC-22 2m FM xcvr	$246
Midland 13500 2m xcvr	$200
Midland 13509 220 xcvr	$200
Tempo CL-220 220 xcvr	$200
Clegg FM-21 220 xcvr	$255
Regency HR-6 6m xcvr	$190
HR2MS 8 channel scanning 2m xcvr	$255
TME-H-LMU 16 channel rcvr	$255
Digital Logiclocks	$ 80
Dycom 2m repeater	$425
Wilson 7 element 10 & 15m beam (pick-up only)	$250
Waller 60A power supply	$105
Standard sr-c 120/5 power sup.	$ 44
Gladding 12V power supply	$ 60
SBE Scannavision	$650
Robot Monitor	$265
Robot Camera	$265
AX 190 amateur rcvr	$200
SX 190 SWL rcvr	$200
Pickering KB-1 keyboard	$200
TPL 502-B 2m Amp 1w/40w	$110
TPL 502 2m Amp 10w/45w	$ 90
Kenwood TS-511S SSB xcvr	$350
Heath HW-202 w/encoder	$180
Heath HWA-202-1	$ 30
Heath HA-2022 amplifier	$ 70

FACSIMILE PAPER for DeskFax units: $1.95 per box. 6 boxes for $10.50; for weathermap recorders; $4.25 per box, 4 boxes for $16. Jim Cooper, P. O. Box 73, Paramus NJ 07652.

FOR SALE: Gonset III 6 meters "MINT", – $100.00. Gonset III 2 meters AM and FM, excellent, – $145.00. WANT: Hallicrafters HA-2. Jim W1VYB, 53 Lothrop St., Beverly MA 01915, 617-922-3850.

OPAQUE/TRANSPARENT PC/IC TAPES. SPECIFY 1X, 2X, 4X. TWO 8 x 10 Assortment sheets plus art worksheet – $3.50. Eugene Wiener, 523 Morgan No., Minneapolis, Minn 55404.

HOOSIER ELECRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Clegg, Drake, Genave, Regency, Standard, Hallicrafters, Ten-Tec, Kenwood, Tempo, Midland, Galaxy, Hy-Gain, CushCraft, Mosley, Hustler, Ham-M, Sony, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal, friendly Hoosier service. Hoosier Electronics, R. R. 25, Box 403, Terre Haute, Indiana 47862. 812-894-1297.

"**Don and Bob**" new guaranteed buys. Discount prices, full warranty. Write for low prices on following: HYGAIN TH6DXX, TH3MK3, 204BA, DB1015A, 402 BA; Mosley CL33, CL36, S402; Triex MW50, MW65, W51 (FOB, Cal); Clegg FM27B; Midland 13500, 13509-W-T; Regency HR2B, HR212; SBE 144 $199.95; SBE 450 TRC converts 2mFM to 3/4m ($179.95 list) $149.00; Standard 826MA, 146A; Ham-M $99.00; TR44 $59.95; AR22R $31.95; Belden 8448 rotor cable 10¢/ft; 8214 RG 8 FOAM 17¢/ft; 8237 RG 8 15¢/ft; Amphenol PL259 49¢; Hallicrafters FPM300 DEMOS, NEED FACTORY WARRANTY REPAIR $460.00 ea; Used guaranteed; Collins 75A4 $345.00; Kenwood R599 $300.00; T599 $350.00; Hammarlund HQ180 $250.00; Heath SB300 $250.00; Write Quote Swan, Eimac, Rohn tower; 3/16" cable clamps 18¢; Motorola HEP 170 epoxy diode 2.5A/1000 PIV 29¢, $25/100 LOT; Motorola Semiconductor Data Series $7.50; Calrad KW dualmeter SWR-relative power meter, to 150 MHz $15.95; MOT MC 1709CG OP AMP (709) TO5 39¢; Write items not listed. Shipping collect. Madison Electronics, 1508 McKinney, Houston, Texas 77002. 713-224-2668 Nite/weekend 713-497-5683

OLD (ANTIQUE) Radio Buffs, Repairers for sale, in working order. Complete (16 Vol.) repair manuals – thousands of service data, schematics, etc., almost all makes from the Twenties to the Forties – Gernsback Official Man. Volumes 1 to 7 (1937) plus Riders Volumes 8 thru 14 (1944), plus Volume 5 (1934) and 16 (1945-1946). Atwater Kent Model 35 battery radio (1924). Majestic "B" battery eliminator (1928). Standard Metal Co. 19" upright horn loud speaker (1925). 16" cone Western Electric Model 540AW magnetic speaker (1928). Cathedral type Crosley table model radio (1932). Old books; old tubes; telegrapher's sounder, key; etc. W. C. Motz, 219 Elm St., Pittsburgh PA 15218, 412-371-1580.

MEMPHIS AREA HAMFEST, Sunday, October 7, at State Technical Institute, conveniently located on Interstate 40 at Exit 11. Tennessee Section ARRL Convention in conjunction. ARRL Forum, MARS meetings, prizes, Flea Market, XYL entertainment. Informal group dinners Saturday night. Talk in on 34-94 and 3980. All your friends will be there!

COMPLETE 36 page QSL catalog, 3rd edition. New "SPARKLING" QSLs. Hundreds of cuts, ten report forms, thirteen colored stocks, 25¢. Ten sample QSL cards. Corneilson's Quality QSLs, 321 Warren St., N. Babylon, N. Y. 11704.

CANADIANS – FREE 120 page electronics catalog ETCO-B, 464 McGill, Montreal.

More CAVEAT EMPTOR

WANTED: ARC-5/VHF components. Mounting Backs MT-65 and MT-71. Control Unit C-42, Junction Box J-28. Also need connectors. WB8NLM, 146 Schonhardt St., Tiffin OH 44883.

DESK-FAX TRANSCEIVERS as removed from commercial service (working). $14.95 each, or $25 pair. Jim Cooper, P. O. Box 73, Paramus NJ 07652.

MOBILE IGNITION SHIELD gives more range, no noise. Everything from economical suppression kits to custom shielding. Literature. Estes Engineering, 543-S West 184th Street, Gardena, Calif., 90248

ROCK CRUSHER – Hallicrafters HT 33A Linear $200, – HT37 $150, – SX 101A $150, – NCX3 TR-Band $150, – NCXD $50, – HT40 $35, – WA8IYL, 419-492-2317.

FOUNDATION for AMATEUR RADIO annual Hamfest Sunday 21 October 1973 at Gaithersburg Maryland Fairgrounds.

COLLINS FOR SALE: Individual prices are indicated. For package deals please write. 32S3 SN 12091 $650, 75S3 SN 14276 $600, KWM 2 A SN 11535 $750, 516F2 P. S. $75, 312B4 station control $125, 30L1 linear amp $350. Jack Aviv, WA2KNC, 106 Glenn Avenue, Lakewood NJ 08701.

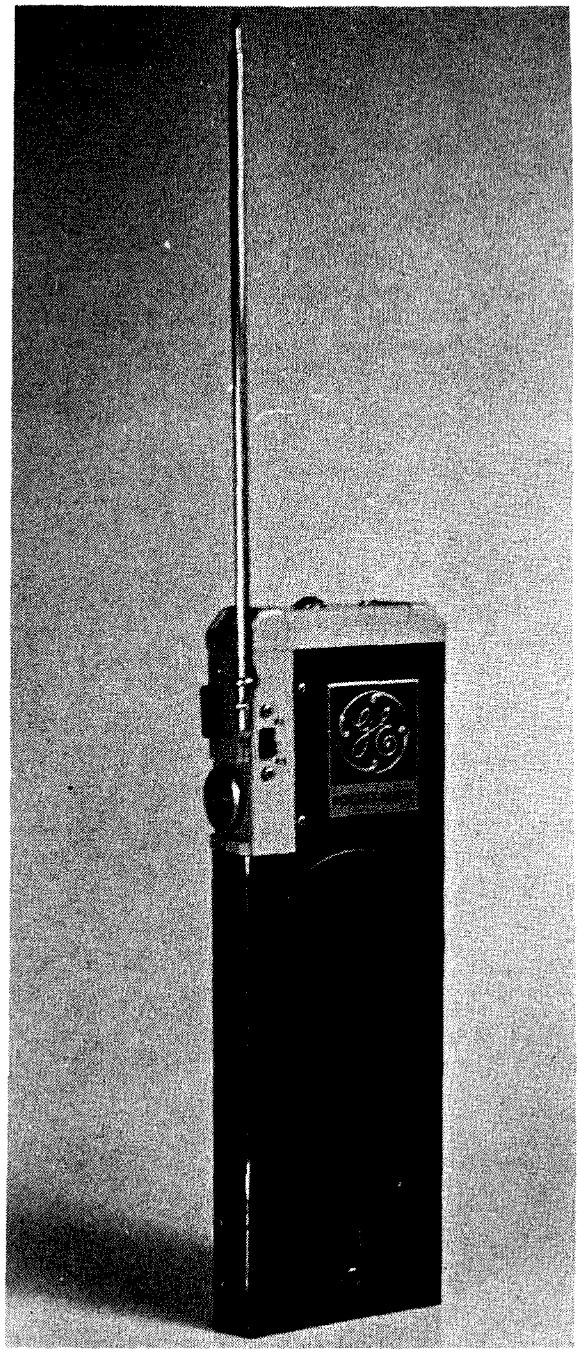
WANTED: RD 92/UX fax recorder. Need several mechanical drum subassemblies. Don W1GBO, Box 803, North Falmouth MA 02556.

"BRAND NEW": Clegg 66er in original factory carton, $145. Money order or certified check. J. A. LaTorre, P. O. Box 521, Lawrence MA 01842.

MOTOROLA P33-BAC 5W Handi-Talkie, excellent condition with antenna, mike, Ni-Cads, 34/94 and 94/94 – $95; Heath HX-20 80-10 meter SSB and CW transmitter, HR-20 80-10 meter SSB, CW, and AM receiver, and HP-20 AC power supply, good condition – $195. FOB, W5PNY, 2506-A, 35th St., Los Alamos NM 87544.

Herman Cone WB4DBB/4
Route 4, Box 493D
Chapel Hill NC 27514

GETTING ON 2m FM WITH A GE POCKET MATE



Recently a number of GE Pocket Mates have become available, and they make ideal walkie-talkies for 2 meter FM. They have several advantages: 1) small size, 2) extremely sensitive receivers (.3–.4 μV for 20 dB quieting, 3) good output (1W), and 4) reasonable price.

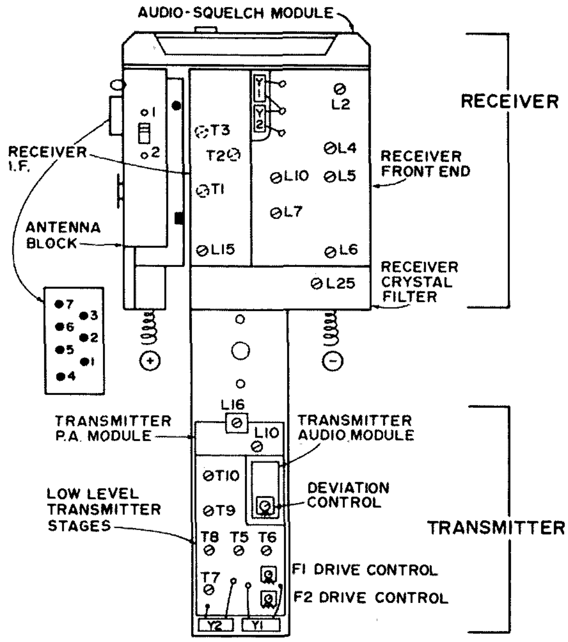
These units are a good buy provided you make sure of several things first. If all of these requirements are met, then you will be making a good investment:

Make sure the unit is dual channel (if you want it) and check for ½–1W output. Check for 1 μV sensitivity and make sure the speaker is good, because it doubles as the microphone. The unit should squelch at a setting between 2 and 5 on the squelch control. The antenna should telescope properly and no corrosion should be present in the battery compartment. Check the operating frequency with a counter; if it is above 160 MHz or so, some of the brass slugs will have to be replaced with green ferrite ones to lower the frequency (It isn't a bad idea to get several extra green and yellow slugs anyway, since they are easy to break.)

To take the unit apart, first remove the screws holding the speaker and unsolder the wires. Then remove the 4 screws fastening the case to the antenna block. Next remove the small screw just inside the bottom (battery) plate. The chassis should then slide out.

Using a tiny iron, unsolder the crystals and replace them with 2 meter ones (available from KW Industries – they already have correlation data). It isn't a bad idea, either, to write GE and request a manual. This makes it easier to find exactly where everything is.

Now you are ready to tune it up. Tuning the transmitter is simple. Hook the two battery springs to a 14V power supply, with a 0–100 mA meter in series. Hang a 47–52Ω 1W resistor from the antenna jack to ground and tune T5-T10 for maximum current. Remove the resistor, extend the antenna, and peak L10 and L16 for maximum output. Repeak all other coils again, and adjust the drive pots for 180–190 mA (change the meter to a 0–1 amp one). T5 and T6 put crystals Y_1 and Y_2 respectively, on frequency. When properly tuned, you



Transmitter Coils

T5 — F1 osc. sets crystal(s) on frequency
T6 — F2 osc. " " " "
T7, T8, T9 — doublers — tune for max. current
T10 — driver
L10 — P.A. tank
L16 — P.A. output filter
Tune T10, L10, L16 for max. output into 52Ω load.

Receiver Front End Coils

L2 — rf amp
L4, 5 — front end
L6, L7 — mixer
L10 — osc. coil (adjust first)

RLVR I-f Coils

Leave these alone unless you are *sure* they are off.
L25 — in filter
L15 — coupling
T1, T2 — i-f coils
T3 — discriminator

Accessory Jack

(Hole directly above jack is for external antenna.)

Pin	1 ext. mic.	5 ext. squelch
	2 ext. mic.	6 not used
	3 13 to 15V	7 gnd.
	4 ext. PTT	

Coil Slug Color Codes

Receiver:
Yellow: L6, L15, L25
Violet: L10 (Yellow Will Also Work)
Green: L2, L4, L5, L7
Transmitter:
Yellow: T5, T6, T7, T8
Green: T9, T10, L10, L16

Receive Crystals (Sc - 18 holder)

$$f_c = \frac{f_0 - 10.7}{2}$$

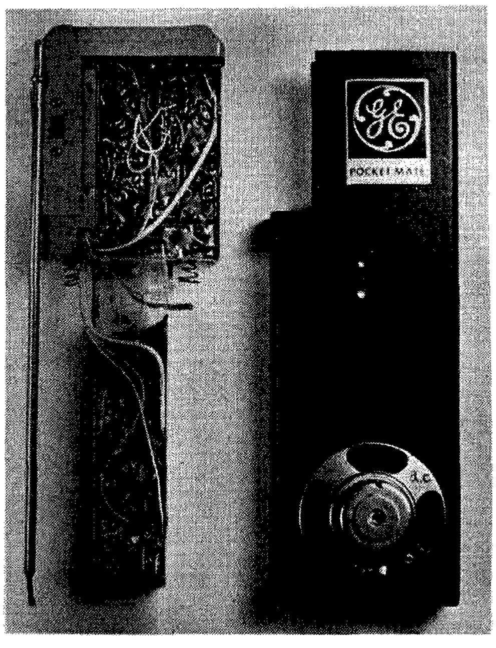
Transmit Crystals (Sc - 18 holder)

$$f_c = \frac{f_0}{8}$$

Fig. 1. Internal diagram and coil identification.

should get around a watt out with 180–190 mA drain. Some units have another pot on the transmitter audio board – adjust it for proper deviation. If yours doesn't have this, it is fixed at 5 kHz. To set the deviation on these units, find the wire going from the audio module to the transmitter's phase modulator. It will have a resistor of approximately 1 MΩ in series with it. Decreasing this value will increase deviation. Also, some units have only one drive control, which controls both frequencies. My own is designed this way.

The receiver is a little more difficult to align, but good results can be obtained if you have a good signal to work with. It is best to use a signal generator set exactly on your receiver's frequency. In most cases, the front end board is the only one that should be touched.



A view of the unit with its case removed.

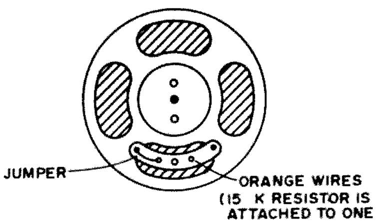


Fig. 2. Rear view of the speaker. Add a wire from the jumper to the chassis to insure a good ground connection. Carefully covering the open areas with tape gives an improved audio response.

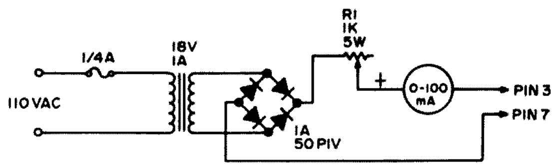


Fig. 3. Schematic of a battery charger suitable for charging the Pocket Mate's Nicads. Starting at maximum resistance on R1, adjust the setting for a meter reading of 15 mA and charge the unit for 10-16 hours.

First, feed a strong signal (30–300 μV if you have a generator) into the antenna and adjust L10 until the crystal "pops" into oscillation. This is a fairly critical adjustment and a change in noise level will be heard. Then adjust all other coils on this board for maximum quieting, reducing the input signal as you go. It should be fairly easy to get a sensitivity of less than .5 μV for 20 dB of quieting. The filter and i-f boards are probably in reasonably good alignment already, and shouldn't have to be touched.

When adjusting the various coils, it is advisable to first melt the wax (if there is any) with a warm screwdriver blade, and to tune them with a flat toothpick, since the slugs are *very* fragile. Check to see that the coils have the appropriate color-coded slugs, since they are made of different material. A vast improvement in audio quality can be had by carefully covering the back of the speaker with masking tape – this is especially noticeable when transmitting. Mallory TR-136 mercury batteries (8.2V) work fine in the Pocket Mate, but for long-term economic feasibility suitable Nicads can be obtained from Alexander Battery Co., Box 1645, Mason City, Iowa 50401.

...WB4DBB

Silas S. Smith WA9VFG
2308 McCord
Murphysboro IL 62966

FREQUENCY MEASURING EQUIPMENT AT MICROWAVE FREQUENCES

This article is not intended to give the theory, but rather a practical solution to the building and use of wavemeters at microwave frequencies.

In microwave work, frequency is one of the most important measurements. It must be understood the wave length in the devices described here is not the exact frequency wave length. A well-constructed wavemeter that has been calibrated can be very precise. They can be within 1.5 MHz at 10 GHz or less than half of a MHz at 1250 MHz. Temperature has some effect on the frequency. Most commercial wavemeters are constructed of Invar, a metal that changes very little with temperature. Some parts are of bi-metal construction to compensate for temperature. For the average experimenter, brass and copper will have to suffice. Although silver plating is desirable, it isn't an absolute necessity. Frequency at microwave frequencies can be measured by three methods: wavemeters, slotted lines, and frequency comparisons. All of these methods are used commercially. The frequency comparison is usually used in the laboratory to calibrate the wavemeter and the slotted line. As a general rule, any method of frequency measurement used at lower frequencies can also be used at the microwave frequencies, but are not always practical. The resonate cavity as a wavemeter is used in microwave measurements.

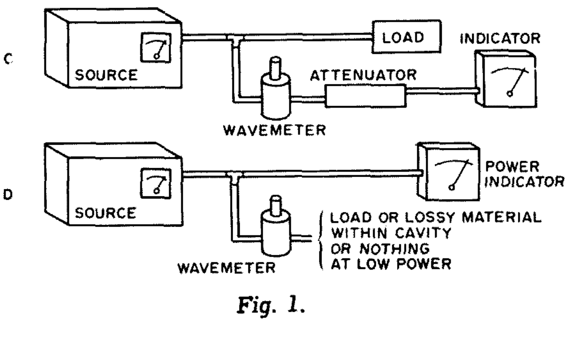


Fig. 1.

There are three types of cavity wavemeters: the transmission type, Fig. 1A and 1B, the reaction type, Fig. 1C, and the assorption or absorption type, Fig. 1D. All are resonate cavities. The way in which the wavemeter is used determines the type.

All wavemeters are adjusted for maximum readings except the assorption type. The assorption is adjusted for a dip in power output. The most popular wavemeter used by the beginner is the open circuited transmission line type, Fig. 2. This type of wavemeter is the equivalent of lecher wires. (Open circuit refers to the standing wave within the cavity, not the physical construction except as it pertains to the frequency wave length.) The practical physical dimen-

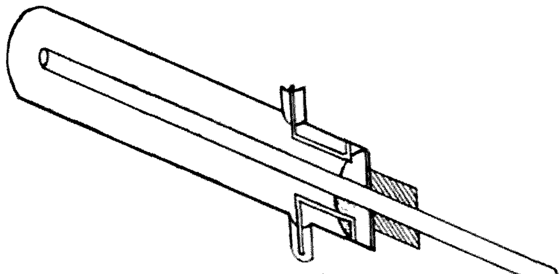


Fig. 2.

sions are not many. The inner circumference of the main tube should be less than one wave length at the highest frequency to be measured. The rod should be small compared to the tube. If inductive coupling is used, the inductive coupling should be close to the shorted end. For probe coupling, the probe should be close to the middle. The open circuited transmission line is generally used in two ways. This type can be used "in line' (Fig. 1B) as it has very little loss when it is resonated. However, it should be removed from the line before transmitting, as it will act as a narrow band filter. The half wave length is the measurement between the two successive points at which the generator will load to maximum, as the rod is inserted or withdrawn.

Another method in the use of the open circuited transmission line calls for the use of an additional circuit, as in Fig. 3. The circuit is a simple crystal diode detector connected to a microampmeter. The diode and condenser are usually built into the connector, as the leads should be kept as short as possible. The half wave length measurement is made on the rod between two successive maximum readings on the meter, as the rod is inserted or withdrawn. See Fig. 1A and 1B for the setup.

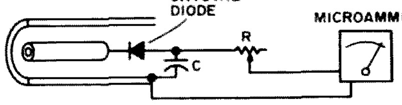


Fig. 3.

The quarter wave coaxial cavity is actually a shorted coaxial line one quarter wave length long (Fig. 4, 5, 6). As illustrated in these figures this type makes a very good cavity to use as a standard. To calibrate, a chart is made of the micrometer settings at different frequency wave lengths from a

calibrated source generator. Don't tell them so, but the Public Relations Department of the Telephone Company may help you here, if they have any microwave technicians close by. The quarter wave coaxial cavity can be either physically open or closed. If closed, the closed end should extend at least a quarter of an inch beyond the center conductor at its lowest frequency. The closing of the end will lower the resonate frequency. Probe (capacitance) coupling as used for coupling in Fig. 5 will shorten the center conductor, and loop (inductive) as used in Fig. 4 will lengthen the conductor. In Fig. 4 we change the length of the center conductor to change its one quarter wave length. In Figs. 5 and 6 the center conductor remains the same, and we change the resonate frequency by capacitance. This method makes it necessary to construct the center conductor very short as compared to the full quarter wave length as in Fig. 4. These devices are not longer, so caution must be used when calibrating. The closed wavemeter as indicated in Fig. 7 is a shorted coax line at each end. The wavemeter uses a shorting plunger which is movable along part of its length. If used as the quarter wave coaxial cavity, the center conductor must be longer than a quarter wave length.

Up to this point we have covered most of the wavemeters that could be used from around 144 MHz up to approximately 3000 MHz. 1000 MHz to 3000 MHz are usually called the lower microwave frequencies. If the inner circumference of the outer tube is kept less than one wavelength, these wavemeters will operate in the desired TM mode.

There are four ways to couple energy into a wavemeter, loop (Fig. 4), probe (Fig. 5), direct (Fig. 6) and slit (Fig. 8). The most commonly used is the loop, as it has very little effect upon the electric field. The usual methods for changing loop coupling is to change the size and orientation of the loop. Loop coupling is usually placed in the high current area of the wavemeter. Capacitative coupling is changed by the size of probe and the distance from the center conductor. Capacitative coupling is usually placed at the high voltage portion of the wavemeter. As in Fig. 5, a small probe – say ½ in. piece of No.

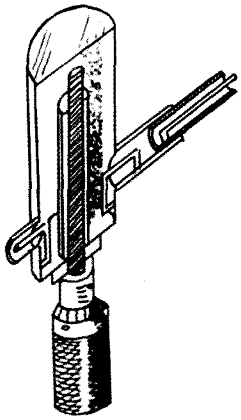


Fig. 4.

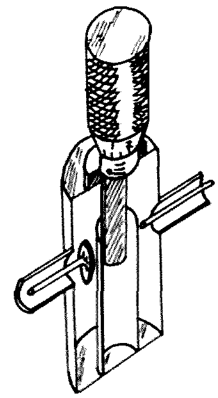


Fig. 5.

22 wire, for example – may require an external voltage amplifier. The smaller the probe, the less effect on the resonate frequency of the wavemeter. In direct coupling as in Fig. 6 the primary concern is impedance. To increase the impedance, move the coupling up the line away from the shorted end. To decrease the impedance, move the coupling down the line toward the shorted end. Slit coupling (Fig. 8) can be a small hole or a series of small holes or a slit. Its purpose is to allow a certain amount of leakage. In all forms of coupling, it is desirable to use loose coupling, as the wavemeter will have less effect on the system, and the Q of the circuit will be higher.

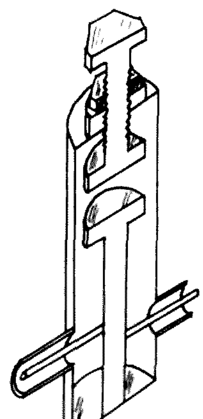


Fig. 6.

Fig. 7.

Above 3000 MHz, usually only the tunable wavemeter is used. The cavity is one quarter wave length long. The cavity can be coupled in three ways: loop, probe and slit. Because of the high frequencies, the slit is usually used, and the meter is most often

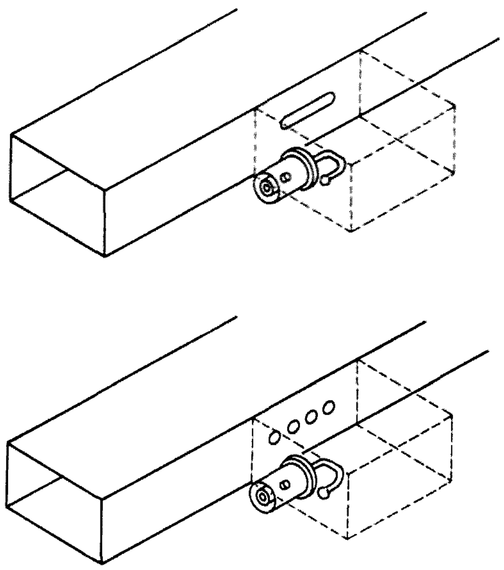


Fig. 8.

kept as an assorption meter. In the assorption method, the wavemeter should be detuned when not in use. Some of the cavity wavemeters have a little lossy material added to absorb some of the energy, as in Fig. 7. Lossy material can be made from graphite impregnated cloth in epoxy.

There is one other type of wavemeter that can be briefly mentioned; it is the reference wavemeter. The reference wavemeter is of any design as described, but would be constructed more like Fig. 6. It can be locked when adjusted to a selected frequency and used as a reference standard. The micrometer assemblies can be made from any micrometer with additional parts welded on. I constructed one using an oversized tube over the main cavity, and dimpled it at various places around its circumference until it fit smoothly over the cavity, and I used a piece of 3/8 threaded brass pipe as the main adjusting screw. I am sure you can come up with a good one without any backlash. This wavemeter spread the 1250 MHz band out to over 100 inches by rough measurements. I haven't calibrated it, so I can't say for sure just how far. There are three nice veeder root counters in the APX 6 which would make excellent wavemeters plus sliding contact material. One could even use the entire cavity.

The last method of microwave measurement that we will look at is the slotted line

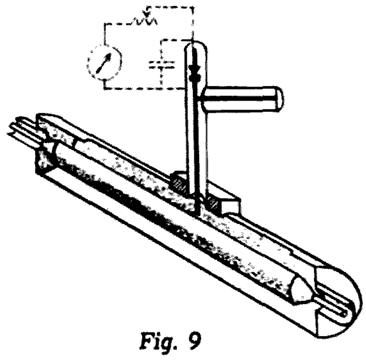


Fig. 9

(Fig. 9). The slotted line is a section of coax line along which is cut a slot. A probe, which is a simple crystal detector with a one quarter wave length shorted stub for a dc return path, is moved along near the center conductor of the slotted section. In this case we are looking for two successive minimum readings along the line. The distance between these readings is one half wave length. A slotted line should also be calibrated. If calibrated at one spot near the intended frequency to be measured, a chart will not have to be made – just a K factor obtained. The distance between two successive readings times the K factor should equal the frequency half wave length. There are a few accessories that can be either built in or used

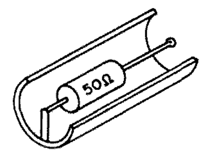


Fig. 10

externally. One is a coax attenuator shown in Fig. 4. It will slide in and out of the other half. It too can be calibrated if one wishes. A 50Ω resistor can be used for an impedance match for 50Ω lines if inductive coupling is used such as in Fig. 10 and when the loop is

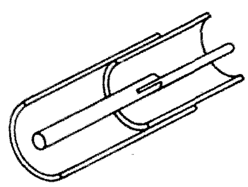


Fig. 11.

small. The line stretcher (Fig. 11) is useful with the slotted line. It merely consists of two coax sections, one sliding into the other.

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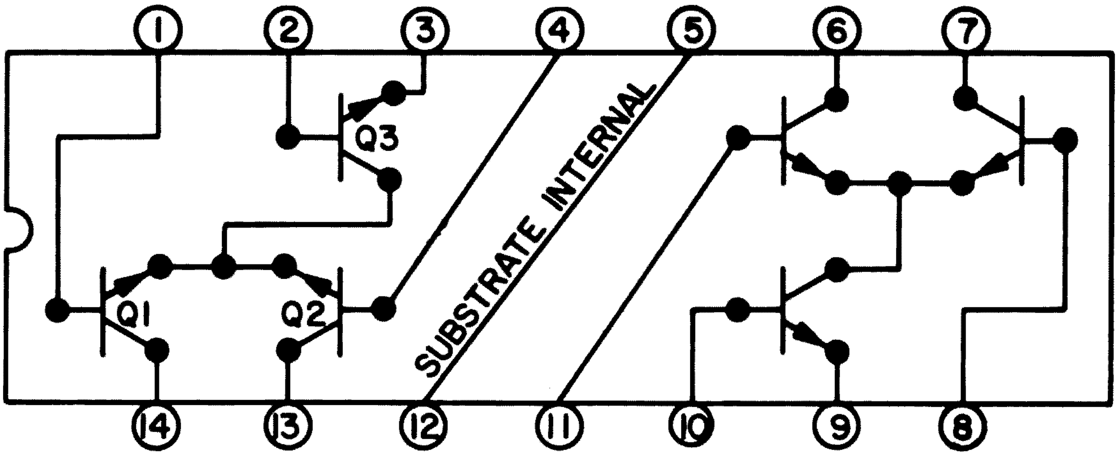

Fig. 1. Build a complete receiver front end with the RCA CA3102E integrated circuit.

Truly it is said, "Nothing succeeds like success," and the RCA lads in Somerville NJ are to be congratulated on this latest achievement of theirs in building an IC which works well as a complete 2 meter front end incorporating rf stage, mixer and oscillator.

This article concerns the RCA IC CA3102E in a 14 pin in-line case which contains six 1000 MHz semiconductors. Bear in mind, please, there is a large difference between integrated circuits for digital work and those for rf work.

This article, like most of mine, is not just a construction article. It deals with the design and philosophy of the components and the circuits shown because I believe amateurs should have the opportunity – if they wish – to learn as much as possible while building. There is a perfectly valid philosophy which concerns "Connect a short red wire between point A and point B." I have done lots of these myself, but always found I had to force myself to forget all I knew about radios and become a true know-nothing while doing it.

The RCA CA3102E

This little gem has two independent differential amplifiers inside, with its schematic shown in Fig. 1. Each of the six transistors has an Ft in excess of 1 GHz, making this IC useful to 500 MHz. Special care has been taken in the internal chip layout to assure good freedom from reaction between the two independent amplifiers. Inasmuch as I seldom write about anything I have not tried out, I have some running here and they work well.

Since the true home-brewer is always interested in possible applications of what he spends his hard-earned money on, the

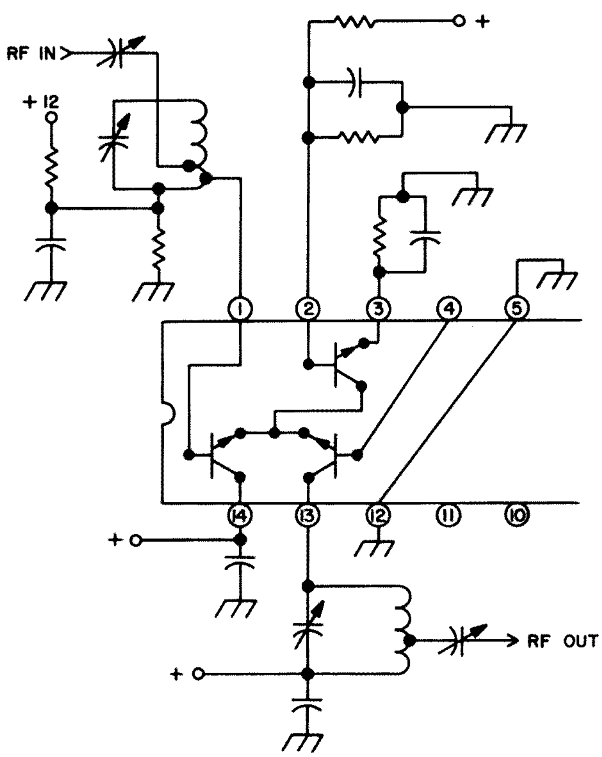

Fig. 2. Differential amplifier connection, RCA CA3102E (pin view). See Figs. 3 & 4 for representative values.

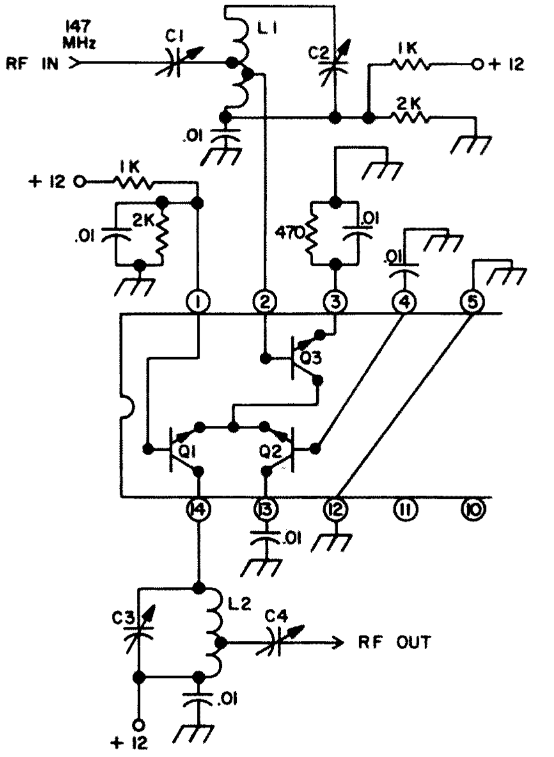

Fig. 3. Cascode connections, CA3102E. For tuned circuit values, see L1 in Fig. 4.

following list of CA3102E uses is included: VHF amplifiers, mixers, multifunction combinations such as rf/mixer/oscillator, converter/i-f, cascode amplifiers for i-f, or dif amps, product detectors, doubly-balanced modulators, balanced quadrature detectors, cascade limiters, synchronous detectors, balanced mixers, synthesizers, balanced cascode amplifiers, sense amplifiers (whew!) and others. The age of the VHF-UHF IC's is being opened up by these 1 GHz beauties.

Dif Amp and Cascode Details

Inasmuch as the L.O. is formed by a cascode amplifier, and the mixer section has an rf amplifier in it, a few words on the use of this chip in both modes is timely. Figure 2 shows one half of this versatile little chip of 1 GHz capability in the dif amp mode, where Q1 is a grounded collector amp driving Q2, a common base amplifier. Q3 acts as a constant-current source. This is the configuration that is best if strong signals are present, as in metropolitan areas, or other areas where amateurs may be in close proximity to each other. This dif amp mode has slightly less gain than the cascode mode, but this need not be considered unless you are trying to minimize components, often a false concept. Two stages with lower gain, such as dif amps, are often much better and easier as well to build and line up then one of higher gain. Noise figure goes *down* with current, another reason for two stages.

Circuit

Referring to Fig. 2, the rf arrives at the tuned circuit L1-C2 from the input matching capacitor C1. A tap about one turn from the ground end goes to the base of Q1, a common collector amp. Q1 is emitter-coupled to Q2, a grounded base amp whose collector circuit has C3 and L3 for tuning. See rf section for details and component values.

Constant-current Source

The makers of these IC rf circuits use a lot of transistors in these tiny chips for this sort of thing. Making them mainly for commercial users, they put in, for example, Q3, which does not appear to do anything at all. It does however do nice things if you look a little deeper. When the temperature varies it tends to maintain a constant current on the amplifier and therefore lessens any detuning effect that might otherwise occur and other nuisance effects. Just use it as shown. It helps for a better circuit, especially when you can take it out in your car in the winter right out of a heated room or garage. After all, it only costs the maker a fraction of a cent to photograph it in there, so why should *you* worry?

Cascode Connection

Figure 3 shows connections for the cascode configuration, which has the highest gain but cannot handle strong signals like the dif amp. The rf goes through the series matching cap C1 (referring to Fig. 3), then to the tuned circuit L1-C2 and then to the low impedance base of Q3, a grounded emitter stage. This stage is cascode coupled to the emitter of Q1, and the signal goes out on the collector to the tuned output circuit C3-L2 and on out through C4. Q2 is not used in this mode, and simply floats for dc, with external connections 4 and 14 bypassed

to ground for stability purposes. Keep L1 away from L2, and use a shield between them if needed. Put the shield more or less in line with pins 5 and 12, as shown in Fig. 3. More details in the rf section.

Internal Feedback and Stability

The compound (internally connected dif amp or cascode) connections of the dif amp or cascode are both much better for internal feedback (having less) than a single grounded emitter transistor, with the best in this respect being the cascode mode. The ratio of how much better may be as high as 1/140 at low frequencies, to perhaps 1/10 at 100 MHz. In the cascode circuit this may be as high as 1/135 to 1/1200. In any case the internal feedback is low enough so that no consideration of neutralization is needed. This reverse transconductance is sometimes labeled Yr, in case you should meet it some dark night. Just be sure the *external* feedback does not clobber the nice internal feature. Pay attention to the details and notes in this article and it *won't* (shielding, bypassing, etc.).

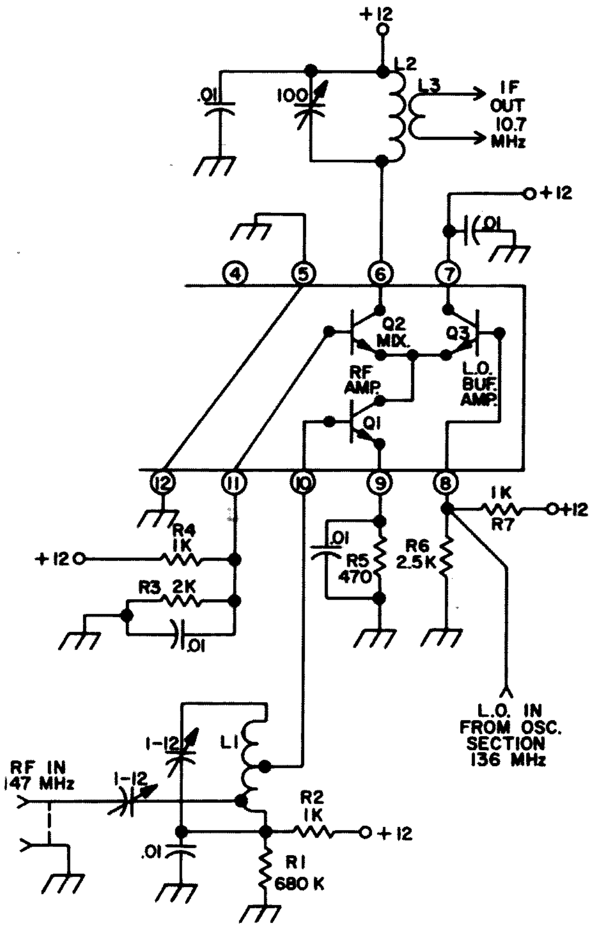

Fig. 4. One-half of CA3102E - use as a complete rf front end. L1, 5 turns No. 20, 12mm long, 8mm diameter. Input tap at 1, output tap at 1½. L2, 15 turns No. 20, closewound 10mm diameter. L3, 2 turns over bottom of L2.

AGC

The mixer gain can be easily controlled to a high degree in these versatile chips, up to 60 dB or more, by putting a negative voltage on the base circuit of Q1 in the mixer circuit of Fig. 5. Remove R3 and put the negative going agc voltage on the base at that point. You will more likely use the agc on the rf amp, though. In that case the agc voltage would be applied to the base return of Q3 through L1 in Fig. 3. A good balance of rf amp current (minimize) and gain, as well as mixer gain, should be sought.

Mixer

Figure 4 shows the half of the CA3102E used as an rf amp, mixer, and L.O. buffer-amplifier. Note the grounded line between pins 5 and 12. I am not quite sure how this is physically arrived at inside on that tiny chip, and it will have to wait for my next visit to Somerville NJ (RCA Solid State Hq), but it works fine. You would have to have a good microscope to find it! Q1 is a grounded emitter rf amplifier which takes the rf signal at 147 MHz in on L1 and direct couples it to Q2, a grounded base mixer stage. Q2's collector goes out at 10.7 MHz to the i-f output transformer L2, link coupled by L3, to the output cable. Q3 is used as a buffer amplifier for the L.O. – the 136 MHz injection voltage coming from the other half of the CA3102E used as the crystal oscillator. This section is quite straightforward even though an rf amp and buffer-amp for the L.O. are included, and works well due to the 1 GHz transistors used. I checked it several times against a good 3N200 FET mixer and local oscillator chain, and it has a dB or so better sensitivity, or I should say conversion gain, than the FET job.

Noise Figure

The noise figure of the CA3102E used as an rf amplifier is highly dependent on

current, as indeed in most semiconductors, 2 or even 1 mA being good figures for rf amps. This noise figure runs about 4.6 dB at 200 MHz for the transistors used in the CA3102E.

There is a fairly simple rule to follow with these units, as already mentioned. Use of the lowest possible total current through Q1's emitter will in general give the lowest noise figure. This refers to the use of the CA3102E as rf amps also. Note the setup for tuning L1, the series cap bringing in the rf and the two tie-points serving as output connectors. This method has proven to be very efficient, both for building the first model and for layout of the PC boards later. If done correctly, each tie-point can serve as a place to drill the PC board for a lead hole, or component tie-in. It is particularly important in VHF and more and more so as you go up into 220 and 450 MHz, to furnish a layout man with exact placement detail. You can no longer leave it to him, at VHF and UHF, unless he knows a lot about rf work and particularly the IC under consideration. You should think this out carefully, as VHF and UHF IC's handle quite differently than af, digital, or control circuits.

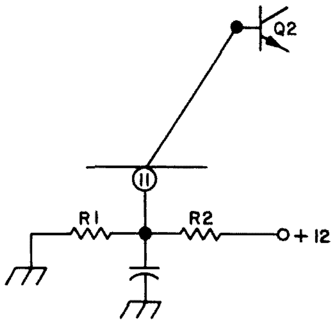

Fig. 5. Example of base bias in the CA3102E.

Base Bias

Due to the direct coupling of the various transistors, placing them in series dc-wise, attention should be paid to the base bias voltages. While in general the resistors may be as in Fig. 5, these should really be adjusted with signals flowing through for checking best noise figure, gain and current. I have already done this for you, but it is a

good thing to learn about. There is also quite naturally a certain amount of interplay between R1, R3, R6 and the current controlling emitter resistor R5. The optimum values are not critical or touchy, but will be seen to be quite responsive to best values. I generally use a 5K pot at the R1, R3 and R6 places to start off with, and a 1K pot as R5. The proper values are soon determined with that arrangement, and you are not left guessing if you have the right values or not. Remember that monolithic photo-built transistors have quite a wide range of parameters at times.

Naturally I ran the mixer when finished, with an outboard oscillator as well as the internal one, to see if there was any reaction between the two halves of the CA3102E when used as rf, mixer and oscillator, but could not find any. It seems to be a "natural."

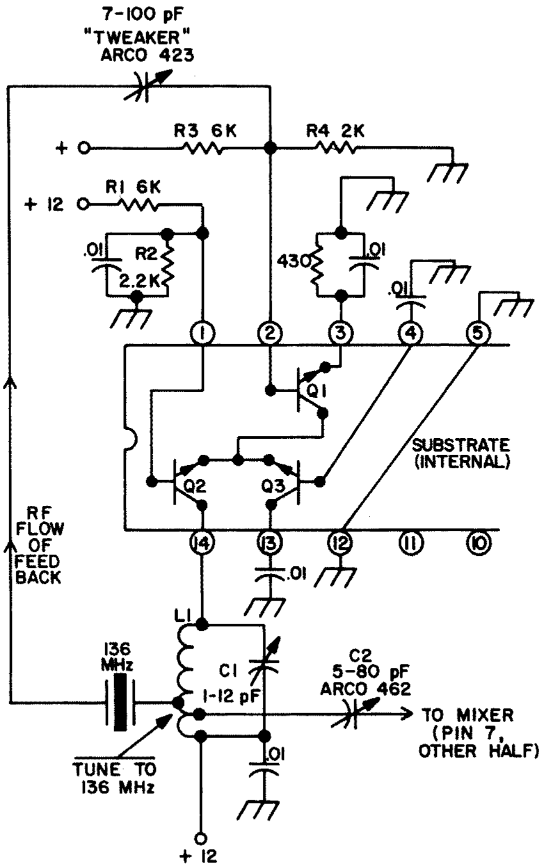

Fig. 6. Internal schematic, ½ RCA CA3102E, IC used in the cascode connection as a crystal oscillator. L1, 5 turns No. 20, 12mm long, 8mm diameter. Crystal tap at 1 ½ turns, output tap at 1 ½ turns.

I have recently developed an IC tuneable, L.O., which also goes very well with this unit. Disable the internal L.O. by pulling out the crystal, and plug in the external vfo cable to pin 8, the base input of Q3. The unit was described in the July 1973 issue of 73 Magazine.

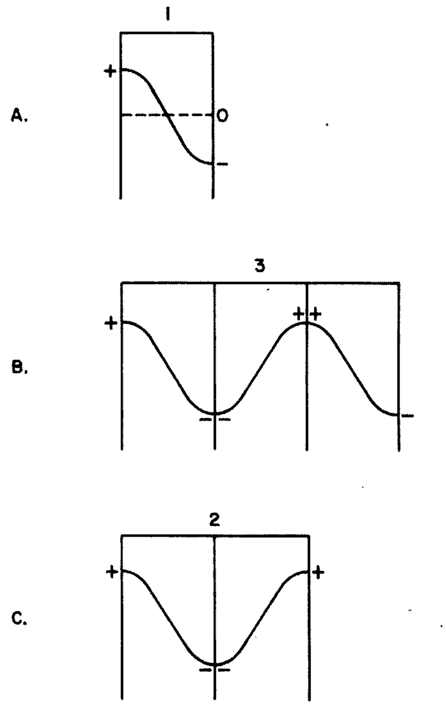

Fig. 7. 136 MHz crystal operation.

Crystal Oscillator on 136 Direct

Referring to Fig. 6, we see the rf signal from the crystal entering Q1 at the base. Q1 is the grounded emitter portion of the cascode amplifier forming the oscillator. Note the crystal used is cut for 136 MHz direct, without multiplication of any kind. Some have expressed surprise at this, but it should be known that today control crystals are available up to 250 MHz direct, not only for two meters. Such crystals are commonly referred to as "overtone," which to my mind smacks of obscurantism, the real functioning of that precious little piece of "glass" being as shown in Fig. 7. This gives you a rough idea of what is going on inside that little tin can. You can also see that only odd numbers can be used. If you try to use the even number combination in Fig. 7C, you will of course get no ac out of it. Never forget that

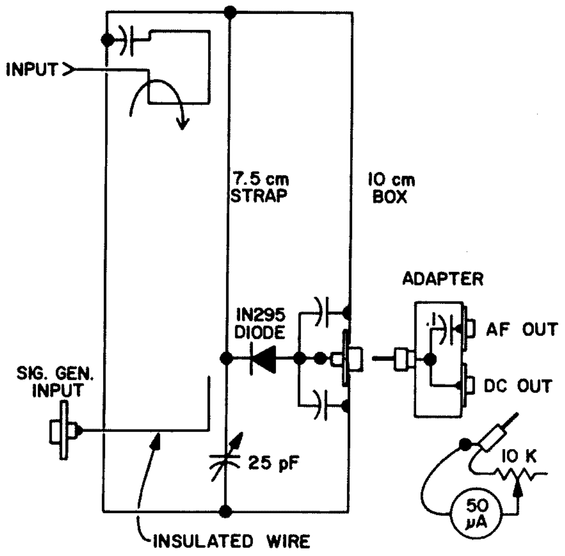

Fig. 8. Oscillator frequency check-out circuit.

a crystal operates on sound waves and that only certain numbers can be used. If this sounds to you like quantum mechanics, good for you, you're getting warm! A piezo-electric chip, if cut right, gives off electricity, positive on one side and negative on the other when compressed, and that is good old dc if you hold it that way! Madame Curie's brother used to demonstrate this nearly one hundred years ago by hitting a piece with a hammer and demonstrating to the entire hall a spark therefrom. What you need first is that the oscillator be running, and if it's a good oscillator, it will be as soon as you throw the switch. It has to run, it's a law of nature. So, as shown in Fig. 5, the oscillator voltage enters the base of Q1 on pin 2, a grounded emitter amplifier. This is internally connected (direct coupled) to the emitter of Q2, a grounded base amplifier, the two-transistor compound forming a cascode amplifier good to 450 MHz. Here it is used at 136 MHz. The output of Q2 goes to a tuned circuit L1-C1, tuned also to 136 MHz. In this circuit, L1 has two taps, one for the output going to C2, and then to the mixer in the other half of the IC. The full gain of the cascode Q1 and Q2 is used and needed. Crystals on 136 MHz are not to be taken lightly. They must be matched as to ac impedance fairly well into and out of the cascode. The input, base of Q1, is sort of a natural, as the base impedance is quite low and the matching can be helped by adjustment of both the base bias and the emitter bias, which I have done for you.

The output match of Q2 into the crystal is done by tapping down on L1, and is also seen to be low in impedance. It is also possible to couple into the crystal by a two turn link, wound in the same direction as L1, and placed over or inside of L1. I generally tune up such an oscillator with a 5K pot as R2, and another as R4. These are not at all touchy but you can make the oscillator run better that way. To check out and tune up – not only for frequency but also for good starting, absence of squegging, noisy hysteresis jumps either in frequency or power and proper base biases – a tuned diode detector is very handy. A one or two turn link around the cold end of L1 with a cable into a diode trough-line cavity does the trick. You must know if it is really on 136 MHz. Figure 8 shows a helpful setup to do this. Set up the tuned diode detector and check for good, smooth, quiet power out, using both meter to measure and af to listen. Then bring in a wire, as shown, close to or around the diode tuner center conductor as shown in Fig. 8. Tuning the signal generator very slowly over the region 135 to 137 MHz, you should be able to hear the desired heterodyne resulting from the crystal oscillator beating with the signal generator on 136 MHz. If you do not, something of course is wrong. Do *not*, as I have said many times before, use a sensitive receiver for these tests.

Test operation should include good, clean tuning of C1 (Fig. 6) with the oscillator coming on and off with a nice "plunk" in the af speaker indicated in Fig. 8. The meter should also come up and drop off with the proper action. Marginal operation is to be avoided like poison. For example, the oscillator may be *just* working, and the next time it won't come on at all.

So there you are. If you build this IC front end as shown, it will work and in good style. I have done it here and it works fine. The operation is stable and secure – not marginal. You can put any rf stage in front, or use another CA3102E as the rf stage.

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INSTANT REPLAY FOR YOUR TAPE RECORDER

At times a tape recorder can be a useful accessory to any amateur station. One obvious use is relaying information directly to another phone station on the net. Instead of laboriously repeating or paraphrasing the message, why not record it on tape and retransmit it to the other station?

The simple control box described in this article makes this procedure a cinch. It has the following operating features:

1. Off-the-air recording may be monitored on the receiver speaker or earphones at any audio level without affecting the recording level.
2. Recorder output may be monitored either for cuing in or transmitting purposes without tying up either the transmit or receive function.
3. Recorder output is reduced to the same level as average microphone output during transmit so that it is unnecessary to readjust microphone gain when switching from microphone to recorder.
4. No modification of the tape recorder or other equipment is required other than adding a short audio cable to the audio gain control of the receiver or transceiver.

A block diagram of the setup is shown in

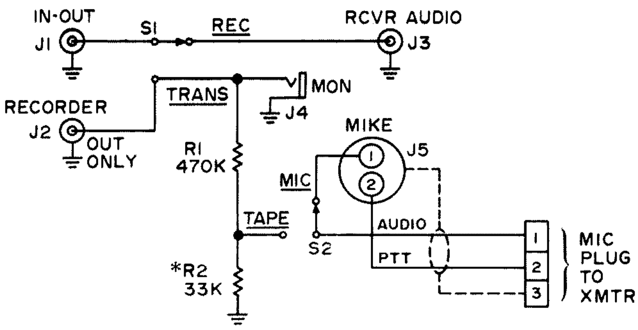


Fig. 2. Control box schematic. Value of R2 should be adjusted so that recorder output is approximately the same as microphone output.

Fig. 1 and the schematic diagram of the control box in Fig. 2. S1 switches the recorder from receiver to transmitter, and S2 switches the transmitter microphone input from microphone to recorder, as required. Resistors R1 and R2 form a voltage divider that drops the recorder output to approximate microphone level. High impedance earphones are directly connected to the high side of the voltage divider for cuing in and monitoring purposes.

Generally speaking, there are two types of tape recorder interconnections available.

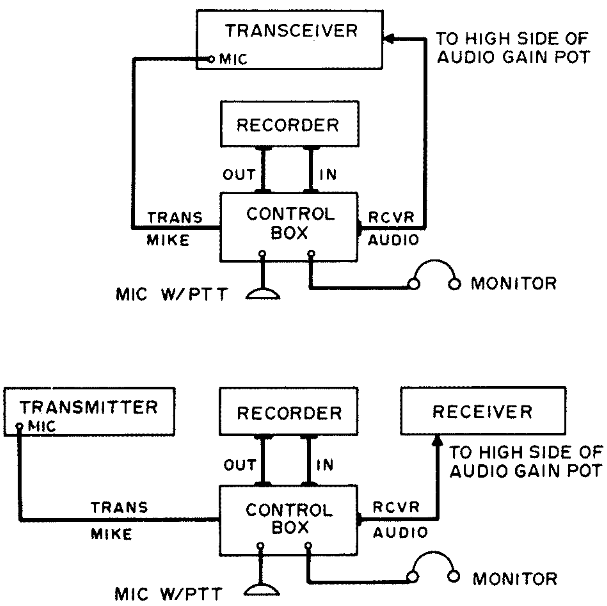


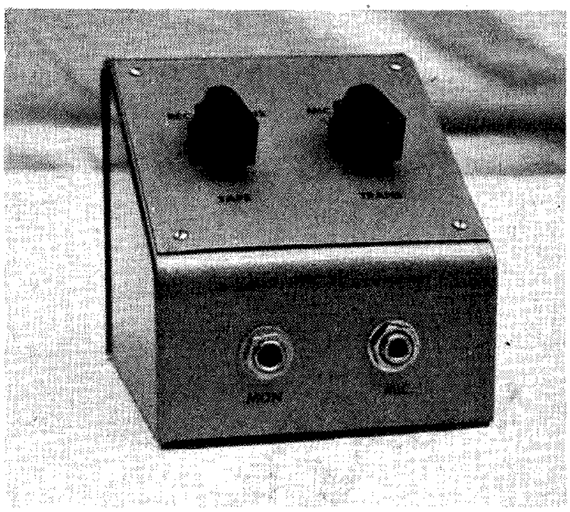
Fig. 1. Tape recorder control box interconnections – all cables are shielded.

Most tape decks have separate inputs and outputs, but many of the older tape decks have only one connection which serves as both input and output, depending upon whether the recorder is in the "record" or "play" mode.

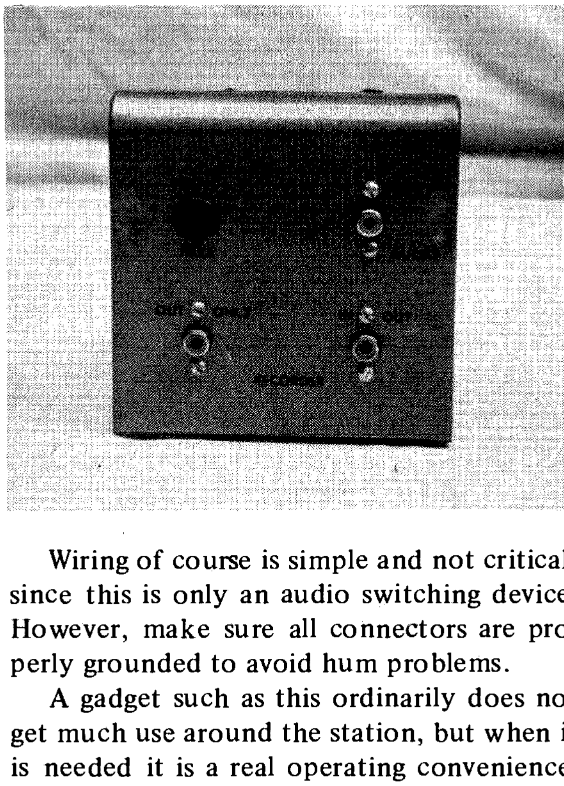
If your recorder has an "in-out" terminus, switch SI must be operated along with the recorder when changing from "record" to "play". If your recorder has separate inputs and outputs switch SI should be left in the REC position at all times. The recorder will then always be properly connected when switching to "record" or "play" at the recorder.

Monitoring while recording may be done conveniently by listening to the receiver speaker or earphones. On playback, the recorder is monitored with earphones connected directly to the recorder output.

My unit was housed in an old meter case. This presents a pleasing appearance and also permits mounting the controls at a convenient angle. The meter hole is covered by a small aluminum panel upon which the control switches are mounted. The microphone and monitoring jacks are mounted in the meter case binding post holes after reaming them out to size. All other remaining cables and connectors are brought out on the rear of the meter case as shown in the photograph.



Front and rear views of control box. Photo was taken before the "trans mike" cable and plug was installed through grommet.



Wiring of course is simple and not critical, since this is only an audio switching device. However, make sure all connectors are properly grounded to avoid hum problems.

A gadget such as this ordinarily does not get much use around the station, but when it is needed it is a real operating convenience. It surely beats haywiring the tape recorder with clip leads and riding the gain, trying to maintain proper output level to the transmitter. There is no reason why this or a similar arrangement couldn't also be used for SSTV, CW, or RTTY.

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2 KW PEP BUILDING BLOCK LINEAR

A simplified construction approach to homebrew a high power single or multiband linear.

Many amateurs have undoubtedly shied away from the construction of a high power linear because they felt the cost or the mechanical work involved in building such a linear would not be justified. After I had built my first few linears, I would have tended to agree with this viewpoint. However, after having built many more linears over the years – and of widely different types – I find that with a small amount of advance planning the construction of almost any power level linear for the HF bands can be attempted by the home brewer using relatively simple hand tools. I should say not only "attempted" by the home brewer, but attempted witn a very high probability of success.

The amplifier described in this article is a particular case in point. It illustrates a particularly simple construction technique and illustrates more than just the construction of a specific linear. By selection of the number and types of tubes used, an amplifier of anywhere from the 200 to 2000W PEP level can be constructed. The cost is very low on a watts to dollar ratio and can easily approach 20W of input power per dollar of material cost.

Planning the Linear

If one looks at the overall diagram of any linear, it presents a rather complex picture; that is, perhaps not so much in terms of electrical functions of the various parts but in terms of mechanical construction when one starts to consider in *detail* how the amplifier will be built and how to arrange all the components on a chassis, do the mechanical work to mount the various components, etc. It is usually at this point that the home brewer starts to falter and forget about the entire project as being too complex and, particularly, too risky. The risk factor comes into play since if one assembles all the necessary parts – tubes, cabinet, chassis, transformer, etc., and then the amplifier project doesn't work out, one will be left with a fair amount of money expended for no real return.

The risk in construction can be almost completely eliminated if one looks at the construction of the amplifier from a different point of view rather than as a complete whole. As shown in Fig. 1, the amplifier can really be considered to be made up of three main "sub-blocks" – a power supply, a pi-network output circuit and a sub-block containing the actual tube circuitry with the antenna switching. The power supply sub-

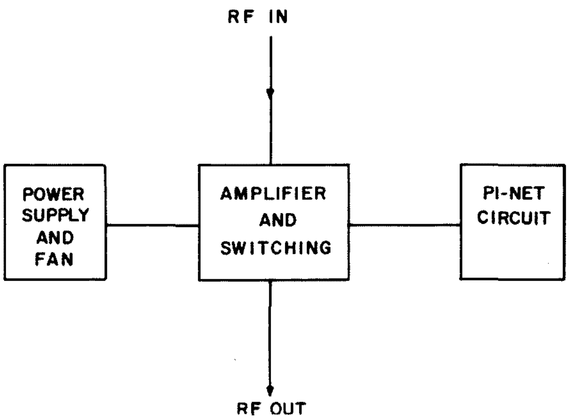
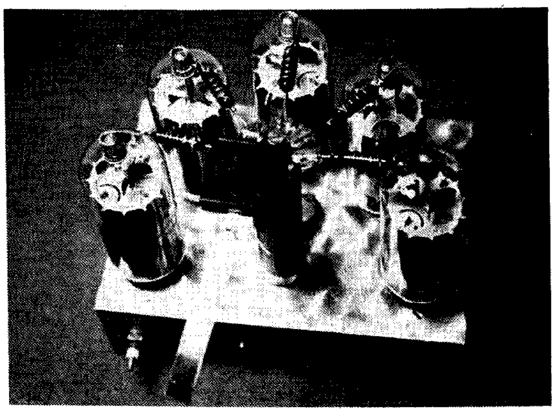


Fig. 1. Most grounded-grid linears can be visualized as consisting of three main constructional blocks.



Top view of amplifier sub-chassis shows how tubes are circularly arranged around plate choke.

block should really present no problem. Any number of power supply circuits are available which have been thoroughly proven in operation and one can even purchase relatively inexpensive high power capacity power supplies on the surplus market or used equipment market. Any amateur should be capable of building a simple bridge type rectifier power supply. The pi-network output circuit sub-block should present even less of a problem. Pi-network circuits for single band or multiple band use using conventional components or using toroid coils have been thoroughly described in many handbooks and articles. With a bit of patience, anyone can find the correct tuning conditions and component values to use with a pi-network circuit on any given band.

However, it is the tube circuitry or actual amplifier sub-block that is at the crux of the whole linear construction project both in an electrical and in a mechanical sense. If this sub-block can be electrically complete so that the *only* other electrical wiring that is necessary is the power supply and the pi-network circuitry *and* if this amplifier sub-block can be easy to construct, almost 70 to 90% of the work in building a linear is done! Of course it will still take patience to complete the linear and to tune it, but one can then have confidence that the linear will work. To take a very conservative approach, one need invest initially only in the components necessary to build the amplifier sub-block without risking a total investment in all the linear components that might not be used should one decide to give up the project.

A 6KD6 Amplifier Sub-Block

This article describes in detail the construction of a linear amplifier sub-block designed for use with one to five 6KD6 tubes. Other tubes can be used as well, using the same construction ideas. Five 6KD6 tubes can provide a maximum input of 2 KW PEP on SSB. The rock-bottom price I could find for these tubes was $1.50 each. They are available new from almost any discount tube dealer for around $3.00 each. Wherever these tubes, or other TV sweep type tubes for use in a linear are purchased, be sure to obtain tubes of the same manufacture. This applies also in case a tube needs to be replaced.

The question of distortion products might be raised when beginning to describe any linear amplifier using TV type sweep tubes. Rather than get involved in this subject, which is not the purpose of this article, it is sufficient to say that the linear described will have 3rd order intermodulation products of -25 to -30 dB. Also, the purpose of this article is not so much to emphasize the use of a particular tube type as to emphasize a particular construction technique. If extremely low intermodulation proudcts are an overriding consideration, one can easily use regular transmitting tubes in place of the 6KD6's. 572B's, for instance, would lend themselves nicely to the type of construction presented here.

Sub-Block Circuitry

If one extracts from a linear amplifier all the circuitry which can be combined to make it as complete as possible except for the power supply and output circuit, the result will be the circuit of Fig. 2. In this case, the antenna switching circuitry has been included in the sub-block. The antenna relay used is a triple pole type so it can also switch a 12V zener regulator in during transmit to bias the tubes properly. During receive the tubes are cut off by the higher unregulated bias voltage to prevent noise generation. The sub-block contains within itself all the external connections needed except the power line connection for the power supply (assuming the power supply will be in the same overall enclosure as the

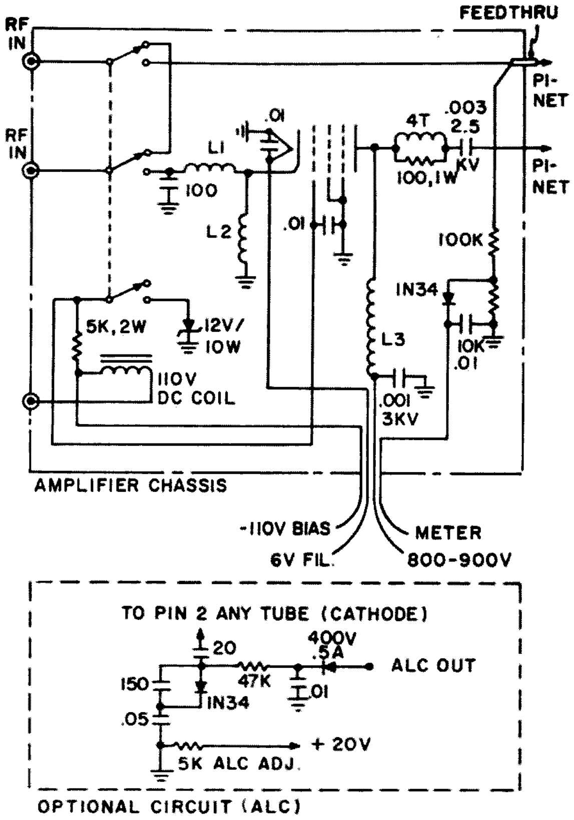


Fig. 2. Amplifier sub-chassis diagram. Up to 5 tubes can be wired in parallel. L1, L2 and L3 are discussed in text.

amplifier). The pi-network output circuit need only be connected between the plate circuit and the feed-through insulator which connects to the antenna relay. The power supply requirements to the amplifier sub-block are: a high voltage from 800 to 900V (at 200 mA peak for each tube used), a filament voltage of 6.3V (at 2.8A for each tube used) and a bias voltage (unregulated) from -25 to -100V at 50 mA. The bias voltage is not critical as long as it is more than 25V so the tubes are completely cut-off during receive. The series resistor for the 12V zener will have to be adjusted according to the bias voltage so that the zener regulates properly without undue heat dissipation. The above are the only external power supply requirements, for the antenna relay is powered by the bias supply line. A monitoring circuit for relative power output is included in the sub-block which would be used to drive a 1 mA meter via a 25K series connected variable resistor. These components would be mounted on the front panel

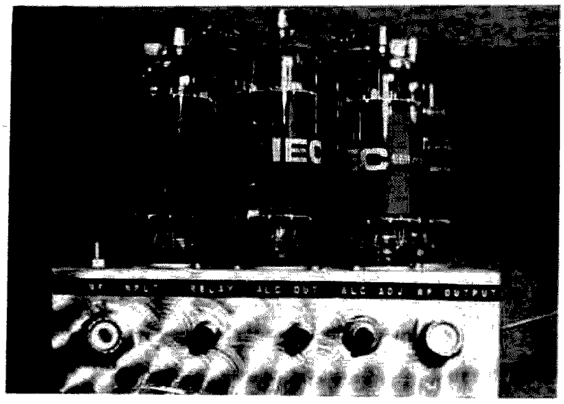
of the overall linear enclosure. This meter plus an ammeter (0–1 or 0–1.5A) connected in series with the plate supply (the ground lead, if possible, for safety) will suffice for metering of the amplifier. A cooling fan is necessary if the amplifier is to be used at its maximum input rating. This can be simply connected across the primary of the power transformer so it is activated at the same time as the power supply is turned on. A 115V fan which is popular is a Barber Coleman D YAF 761-110 with their AYFA-403 fan blades. The larger electronic mail order houses can supply this item. Other suitable surplus type fans can also be used, but there must be a good flow of air (about 100 cfm). The 6KD6 tubes run hot and I have seen several removed from TV sets where under normal operating conditions the glass envelopes have started to distort due to heat problems.

The external connections for the amplifier sub-block consists of the usual rf input and output connectors, a relay connection for switching the linear to transmit via the exciter, and an alc connector for use with the exciter. The latter is an optional feature which can be used if the alc voltages needed by the exciter from the driven linear are known.

The actual circuitry of the amplifier sub-block is extremely straightforward. The 6KD6 tubes operate class AB in a grounded grid configuration. The tubes are not individually current balanced and this is not necessary as long as the tubes used are of the same manufacture. The input circuit to the cathodes of the tubes contains a low-pass filter (L1 and the 100 pF capacitor). This filter helps to prevent further amplification of harmonics from the exciter used and improves the overall distortion rating of the linear. L2 is an rf choke which will pass the cathode current of the tubes while still keeping the cathodes above rf ground. The choke is quite easy to construct and consists simply of close wound turns of #24 wire on a 1.25 cm by 7 cm long ceramic or high temperature plastic form. L3 is the plate rf choke. One has the choice of using one of two simple approaches to construct a suitable rf plate choke. The choke I used is wound on a 9.5 x 2 cm ceramic form with #24 wire. It consists of five sections, each section separated by about 1 cm. The top section consists of 11 turns and the following sections are 16, 27, 33 and 43 turns. A somewhat simpler rf choke can be made if desired, but then two chokes have to be used in series. The first choke is wound full with #24 wire except for 0.5 cm at the top and bottom. The second choke is an Ohmite Z-50. The .001 μF plate bypass capacitor is used after the Z-50 choke, not between the two chokes.

Construction

The amplifier sub-block is fully contained on a standard 5 x 7 x 2 in. aluminum chassis. The tube sockets are arranged in a semi-circular fashion with the rf plate choke in the center. The circle is arranged so the center of the end tube sockets are about 2.5 cm away from the side of the chassis on either side. This will permit the tubes to be separated enough to allow good air passage while not allowing the rf leads to become too long. The rf plate choke is about 2.5 cm away from the edge of the chassis also. The tube sockets are oriented so that the number two pin (cathode) on the socket always faces the center of the semi-circle. At the rear of the chassis, the connectors used are a SO-239 for the rf input, phono jacks for the relay control and alc output (if used), and another SO-239 for the rf output. The alc adjustment potentiometer is also located on the rear panel of the chassis. The use of



Rear view of amplifier shows arrangement of connectors. Single hole mounting SO-239's are used to facilitate bolting of amplifier sub-chassis into an overall enclosure.

single hole mounting SO-239 connectors and phono connectors greatly simplifies the mechanical work involved.

At the underside of the chassis the antenna transfer relay is mounted on one side wall above a tube socket and close to the front panel. There is no need to mount the relay in any exact position but it should be mounted nearly as pictured so the length of the wire between the rf output connector to the pi-network is as short as possible. This is to minimize coupling between the output line and the rest of the amplifier circuitry. A short piece of coax is used to go from the relay to the input connector. The zener diode for bias regulation may be mounted in any convenient location near the relay. The cathode of the diode is directly bolted to the chassis, as the chassis functions as a heat sink for the diode.

The wiring of the cathode circuitry of the tubes deserves mention. This wiring should be kept as short as possible and an insulated terminal post is mounted for this purpose in the center of the ring of tube sockets. The post can be held in place by the same screw which supports the rf plate chocke on the top of the chassis. The cathode choke, L2, is mounted on the side wall of the chassis opposite the relay. The low pass filter coil, L1, is wired between the relay contact and the cathode terminal post in the center. Also the 100 pF capacitor associated with the filter is wired in beneath L1 and utilizes the bottom of the center terminal post for ground. You can also use the ground post of the small terminal strip located in the middle of the inside front panel. This latter terminal strip supports the few components for the relative rf output level circuitry. The 100K resistor in this circuit can be seen going between the relay and the terminal strip. Each cathode pin of the tube sockets is connected with an equal length lead to the center terminal post. 0.5 cm wide copper material is preferred, but large size wire such as #12 or larger can also be used.

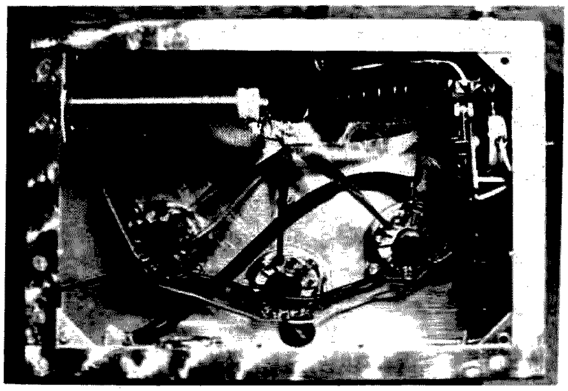
simplify the wiring of the chassis is to wire the tube sockets as fully as possible before mounting them, then complete the wiring of the sockets on the chassis, mount the rest of the components on the chassis and then complete the final wiring. The whole process may sound a bit involved, but actually once the chassis has been drilled and the components assembled the whole wiring can be completed in an afternoon.

All the pins on the tube sockets are wired to ground via the ground lugs on the sockets before mounting the sockets on the chassis except pins 2 (cathodes), 12 (filaments), 5 and 9 (grids) and 7 (internal tube connections). The two .01 bypass capacitors associated with each socket are wired in at the same time. Once mounted on the chassis, the filament pins (12) and grid (9) are wired together from socket to socket. The wiring to the power supply leaves the chassis via a grommet on the side wall opposite the relay.

The mechanical working of the chassis can be done completely with hand tools if desired. The only large holes which require work are the ones for the tube sockets and the SO-239 connectors. These can be made with a punch or with a nibbling tool and round file. There is little sense in investing in a punch if one is not likely to use it again, but a nibbling tool can be used for a variety of chassis work.

Pi-Network Circuits

A number of pi-network circuits have been tried which will work properly with the amplifier. If the linear is to be used on only one or two bands, the pi-network circuitry becomes quite simple and one need only experiment with the component values that produce the highest power output. Extract the single band component values from the



Bottom view of amplifier sub-chassis showing wiring of cathode leads to a central terminal point. Note also placement of 3pdt relay on side of chassis.

multiband circuits shown in Fig. 3. Under properly loaded conditions and with 800–900V on the plates, the CW plate current will run 200–220 mA per tube used. For the full five tube circuit, the plate current for CW can be loaded up to between 1. and 1.1A. The key-down periods must be kept to 10 seconds or less.

If an 80 to 10 meter multiband pi-network output circuit is desired, Fig. 3 presents two good possibilities. The first circuit has an advantage in that it requires only a conventional 2 pole, 5 position switch for all of the capacitor and coil switching functions. The second circuit avoids the use of auxiliary fixed capacitors for the lower frequency bands but the plate tuning capacitor shaft requires an insulated shaft coupling and mounting above ground. In any case, the final coil tap positions should be experimentally peaked up for maximum power output on each band. The plate tuning capacitor in either circuit should have 1000–1500V spacing while the output loading capacitor need only be a broadcast band type. The fixed capacitors should be mica or ceramic types rated from 1 to 3 kV. Ceramic transmitting type capacitors such as the Centralab 850S are preferred if one can find them surplus at a reasonable price.

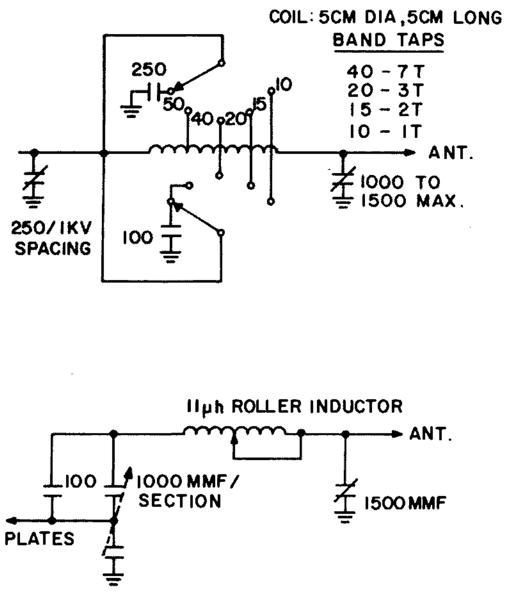


Fig. 3. Two good pi-network circuits which can be used with a 5 tube 6KD6 amplifier for all band operation.

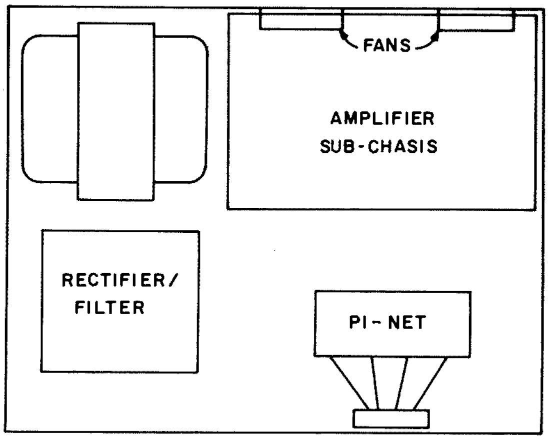


Fig. 4. There are many ways the amplifier sub-chassis can fit into an overall enclosure to fit almost any taste. Build the sub-chassis first and then integrate it into an overall enclosure.

Final Enclosure Assembly

Exactly how one wishes to finish up an amplifier in an enclosure depends to a good degree on how fancy an appearance is wanted, so this part of the project is pretty well left up to the desires of the individual builder. Certainly, if the power supply is ready, the amplifier chassis finished and the parts for the output circuit secured, the grouping of these items in an overall enclosure is not a big problem.

Although not one of the fanciest approaches, but certainly a simple and adequate one which I have used for a number of amplifiers, is the use of standard large size metal utility cabinets (Bud CU or AU series, Par-Metal MC series) as the overall linear enclosure. These enclosures are inexpensive ($5 to $6) and come in black wrinkle steel finish or bare aluminum. The black steel cabinets are attractive in that they need no further painting. These enclosures are typically square looking with removable top and bottom covers. The mounting of the amplifier sub-chassis in such an enclosure is particularly simple since the connectors on the back of the amplifier sub-chassis can be used to secure the sub-chassis to the enclosure. Figure 4 shows how the total linear might be assembled in such an enclosure. For ventilation purposes, a series of holes should be drilled in the two side walls of the enclosure which are in the path of the air flow produced by the cooling fan used.

. . .W2EEY

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YET ANOTHER RF WATTMETER

Many VHF operators would like a cheap, accurate instrument to measure rf power. The same desire is frequently expressed by operators of the HF bands. Here is a very simple wattmeter which when used with a 50Ω transmission line or load has all of the following desirable characteristics:

1. Easily calibrated to good accuracy (±5%) with your multimeter and a variable dc source;
2. Perfectly flat from dc to 450 MHz;
3. Insertion VSWR less than 1.05
4. Power readings in the 2 to 50 watt range (higher power can be measured with slight design changes);
5. Cost of approximately $20.00, assuming the use of a surplus microammeter.

The operating principle of this wattmeter is stark simplicity. A pilot lamp across the rf line senses a small portion of power in the line and glows brighter with increasing power. An appropriately located photovoltaic cell connected to a microammeter measures the light output which is proportional to the power flowing in the line. Of course a good deal of nonlinearity is involved in the various elements – both the lamp's resistance and its spectrum output change with heating; output of the photovoltaic cell varies considerably with both the amount and frequency of the light shining upon it. Some of these factors tend to cancel out however, because the photovoltaic cell produces some current with only infra-red lamp output at low power levels before the lamp even produces a visible glow, and the cell tends to saturate, increasing its output quite slowly at more intense illumination levels.

Probably the biggest single requirement of any wattmeter is that it must be capable of being inserted into a transmission line without disturbing the operating conditions in the line (low insertion VSWR). It might be argued that hanging a lightbulb across a transmission line will seriously affect the line impedance. Ordinarily, this is true, but the undesirable changes can be minimized and indeed approach an insignificant level

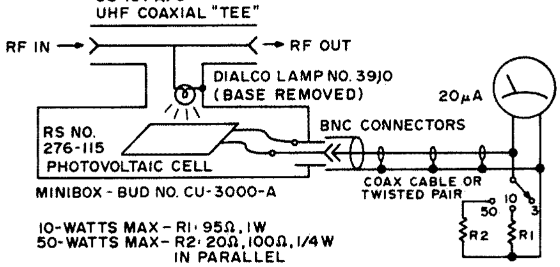


Fig. 1. Schematic diagram.

if the resistance of the lamp filament is very large when compared to the line impedance. In general, a factor of 15 or more times the line impedance is sufficiently large to produce negligible effects. In the case of the suggested 10V, .014 Ampere pilot lamp, the mismatch produced in the line gives a VSWR of 1.05:1 at the power level of 1 watt. This mismatch decreases rapidly with increasing power. It falls to well below 1.01:1 at 50 watts. Another point of interest with regard to this particular choice of lamp is that it is a long-life type with a life expectancy of 10,000 hours. This implies two advantages: (a) The lamp will operate at well over its rated voltage without burnout (50.0V at 50 watts), and (b) the interior of the lamp envelope will resist darkening which would negate the wattmeter calibration. In addition, the filament structure of this type of

lamp is a single-strand straight tungsten wire. The coiled type of filament structure introduces undesirable inductance into the circuit which can distort wattmeter readings in the UHF range.

The wattmeter shown is constructed in two boxes for the sake of convenience. The sensor can be located in the transmission line at any point and the meter can be placed beside the transmitter. For test work, the whole unit could easily be put into a single box. Coaxial fittings and cable were used for interconnection, but since dc only flows in this circuit, any type of wiring would be satisfactory.

The photovoltaic cell used in this wattmeter is a unit obtained from the local Allied/Radio Shack store. (Catalog No. 276-115.) Output of the cell is rated .5V at .6 mA in sunlight.

Since the cell generates considerably more than 20 mA under moderate illumination, a switching arrangement is incorporated into the wattmeter to shunt it into progressively higher current ranges with increasing power. Alternatively, a 50 or 100 milliammeter could be used with less switching at a sacrifice of sensitivity in the 1–3 watt range.

Calibration of the wattmeter is a simple process. By solution of the formula $P = V^2/R$ for voltage, the following tabulation is made for a 50Ω line impedance:

VOLTAGE (rms or dc)	POWER (Watts into 50Ω)
7.07	1
10.00	2
12.24	3
14.14	4
15.71	5
17.32	6
18.71	7
20.00	8
21.21	9
22.36	10
31.62	20
38.71	30
44.71	40
50.00	50

Using the tabulation, fasten a metered variable dc supply into the wattmeter according to the following diagram. Now simply note the reading on your wattmeter for each of the selected voltages in the table and tabulate this reading with the corresponding power in watts in a table of your own. It may even be possible to remove the front of the meter case and mark new calibrations directly on the dial. This was not possible with some hermetically sealed meters. It is best to disconnect the wattmeter from the antenna feedline for this calibration. If the meter is left with a transmission line attached and the antenna happens to be fed through a balun device with near zero resistance, the power supply, and perhaps the balun, will suffer.

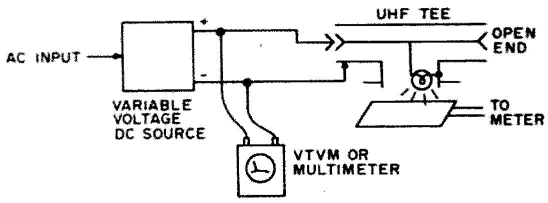


Fig. 2. Calibration diagram.

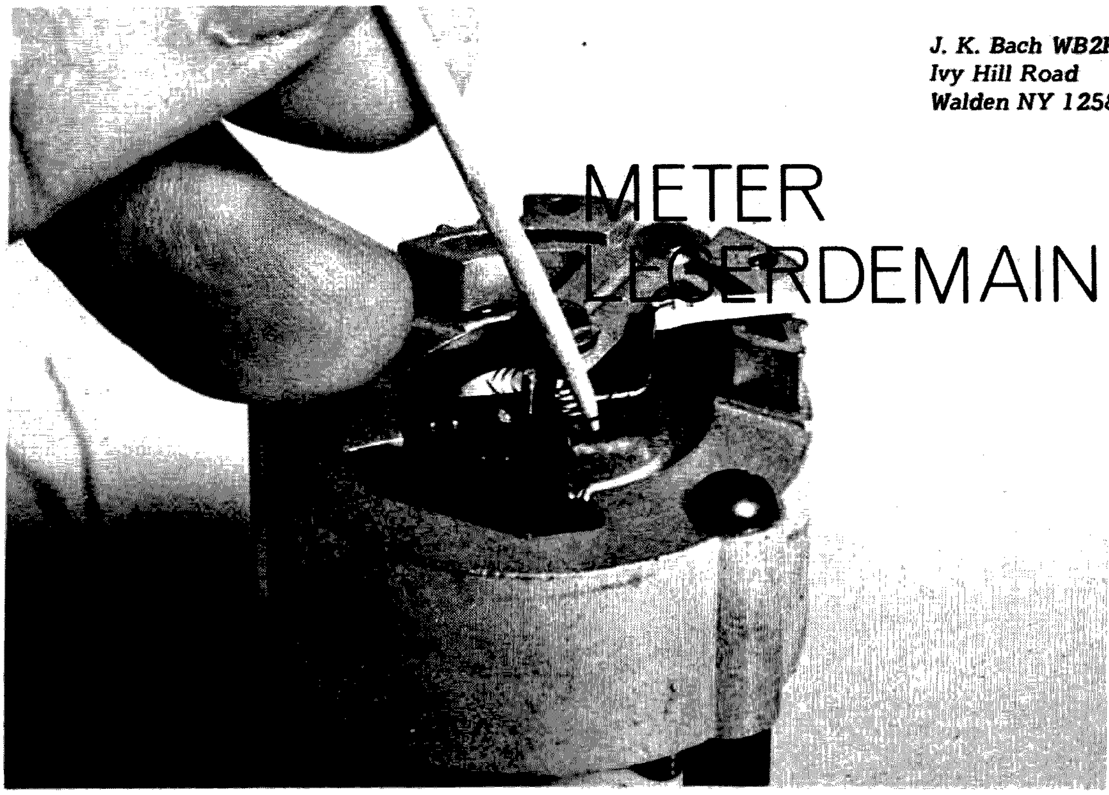
It must be pointed out again that this power meter is intended for use either with 50Ω coaxial line systems with low VSWR or with 50Ω dummy loads. A coaxial line that is not "flat" (unity VSWR) or a dummy antenna that does not look like" 50Ω, which is the case with most HF loads used at VHF or UHF, may cause distorted power readings. If you have doubt about your transmitter's power output when using this meter, you should check it while using a known 50Ω load rated at the transmitter's output frequency.

I mentioned before that this power meter was easily adaptable to higher power readings. To upgrade the meter, the only change required is to insert the correct higher voltage pilot lamp having low current, long-life specifications. Suggestions for some of these are the following Dialco Lamps:

Part No.	Max Power Level (Watts)
24CS	100
48CS	200
60PSB	340
120PSB	800

. . .K5CXN

J. K. Bach WB2PAP
Ivy Hill Road
Walden NY 12586



METER LEGERDEMAIN

Nobody in his right mind would fix a meter by choice, any more than he would operate on his wristwatch. But fate, which seems to be a generalization of Murphy's law, determines that sooner or later you will be faced with the necessity. One day you are minding your own business and your boss sidles up to you like an affectionate bison, mumbling something about how easy it would be for you to fix this (heh heh!) meter in your spare time. Or it's your own meter that went ape on a weekend. Whatever the motivation, you decide to take a hack at it.

I had never fixed clocks or watches, but I had reversed a tuning meter or two to read up-scale, so meters held no terrors for me. The first time I was handed one to fix at work, I started out with a show of jolly self-confidence and proceeded to lose my patient – irretrievably – within minutes. The second worked if you tapped it continuously and held your mouth right. The third and fourth I don't remember, but the fifth worked as good as new. By this time I had made most of the more stupid mistakes, learning a bit from each. A meter repairman would laugh himself sick at my methods. Were I in his position, with his facilities and skills, I would laugh too. I'd laugh even harder watching *him* work on a meter with *my* facilities. He has to work fast to make money and has all the parts he needs. He replaces whole assemblies, as an automobile mechanic does. I have to straighten the kinks out of hairsprings, but I have lots of time. My boss gives me the job because when he sends any meter to any shop he knows how long it takes to get it back. This is true of all shops all over the land. Even buying a new one takes a lot of time, which is why so many of us are volunteered to fix them.

The tools are very simple. A good light, such as a desk lamp, is very useful but not essential if you have young eyes. I haven't. The next thing is to provide a spread newspaper to work on. Meter magnets will attract steel filings and steel wool fuzz from incredible distances. These have to be swabbed out of the air-gap with Scotch tape. One session of this will teach you to spread a clean newspaper.

The second lesson is, no magnetic tools. You naturally try to use your familiar long-nose and screwdriver, but at best you can't control them closely enough near the magnets and they are hazardous besides. What you need is a non-magnetic toothpick. It can be round, like the one in the photograph, or the old square kind. You can

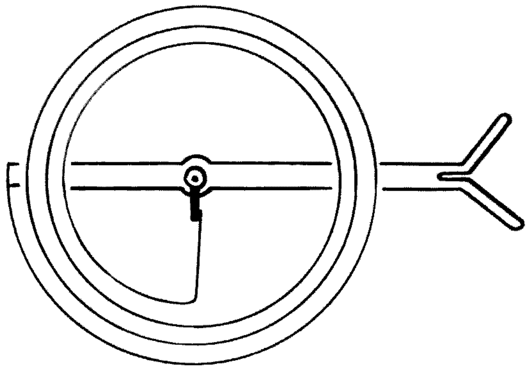


Fig. 1a. Top view of a healthy meter spring.

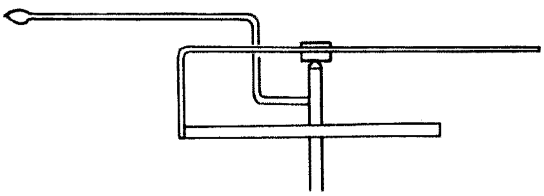


Fig. 1b. Side view with indicating needle added.

cement two together to make a tiny fork for straightening needles and unkinking hairsprings.

By all means get a magnifying glass if you can. Older guys tend to keep them in their toolbox. One of the handiest kinds is the jewelers' loupe with the steel spring headband on it. The monocle type will cramp all the muscles from your big toe up, with the effort of keeping the silly thing in your eye. Use your own judgment.

Duco or other plastic cement is handy, but do not use it directly. If you have to cement a needle, transfer an invisible dab of cement with the end of a toothpick. Get just one drop of cement in a hairspring and no amount of any solvent will ever get it out. The only cure is to take the meter in your right hand, take a good windup and let fly eastward. This will save you an ulcer in the long run.

All this talk and nothing about the actual work yet? Patience! Watch a good machinist at work – two hours and a half on setup, and two minutes for machining, that's his rule. The beginner reverses these times and strikes out with ruined work. Meter fixing is like this – utter despair can be followed by delirious delight within a few seconds. Nearly every hairspring trouble is fixed very suddenly or not at all. And all the other troubles taken together are few.

One more warning: the PAP syndrome (WB2PAP). This is not to be confused with the PAP test which is entirely unrelated. The effect is a spasmodic jerk of the hand which, by Murphy's law, invariably stretches the hairspring to its full length and ruins it. This nervous jerk is brought on by fatigue, and I believe it is due to the loss of feedback to the brain, which tries to locate the hand position and reset it, with disastrous results. I don't fully understand the mechanism – who does? – but I know a good way to prevent it. *Never* work free hand. Take a look at the photograph which illustrates this. See that third (fiddle count) or fourth (piano count) finger touching the meter magnet? With it, or any other finger or part of the hand touching, the brain knows right where the hand is, and keeps it there. Also the movements are measured in millimeters, not inches, and finger contact helps with this. It also helps impose gram forces instead of ounce forces. There, I've saved you one meter already.

Another warning – leave the jewels and pivots alone. With a brand new meter, fresh out of the box, you can move the needle along its length a full thirty-second inch, a clearly visible amount. You can even feel the motion of the pivots in the jewels. Everybody has a thing about pivot adjustments, and so did I, once. The natural thing is to take all the slack out – just. But meter pivots should be left sloppy for the least drag.

If you must take meters apart beyond the minimum possible stage, you will need something to put the little screws and nuts and insulators in. I like a baby-food jar. A heavy ash tray is good too; or both. But keep the parts in the jar until you have to put the meter together again, else you may hit the ash tray with your elbow and shower itsy-bitsies all over the place. And tweezers – sound good? Like the idea? Ever "shoot" a little nut or screw clear across the room and into the nap of the rug? Maybe you have the requisite skill to use tweezers, but I want no part of them.

At last – the broken meter. Take the front case off. Is the winding open? Blow the needle to full scale a few times and see how quickly it restores to zero. Now short the terminals and repeat. If the needle restores as fast as before, either the air-gap is very wide or you have a wiring trouble. It figures to be the coil, but several times I have found it in the shunt or multiplier resistances, or other wiring.

Now if the needle is stuck, make sure it really *is* the needle. It can actually stick to one of the stops (rare), scrape on the scale, hook over a scale-screw, or be biased off low mechanically. In any case the needle must be okay before any other source of drag can be located. The air-gap may have filings in it, or the hairspring tangled.

If the air-gap is fouled up, take a short length of Scotch tape and swab it clean. It isn't fun, but it can be done.

If the hairspring is tangled or distorted in any way, the best thing is to just look at it from all angles, in all kinds of light, under the glass (low powered one will do). Try to figure out just how in thunder any normal human being could get the hairspring in such shape – but don't touch it yet, just look at it. This will save you a lot of time.

Figure 1a sketches a view of two *moving* parts-hairspring and shaft with side-lug. Also shown is the zero adjusting fork, which also revolves around the same axis as the shaft and pivots. Figure 1b is the same thing from the side, with the indicating needle added. No fixed supports or anything else are shown. All this for comparison.

Now look at Fig. 2a – what causes the bunching at the bottom of the coils? This is very difficult to see unless you have experience. Someone before you has had the meter open and touched the hairspring not quite gently enough. He has put a permanent set at the outer attachment, bending it toward the shaft right where it is soldered, along the horizontal plane of the spring. You can work at this for hours, making it worse and worse. But once you know exactly what the trouble is, you take the non-magnetic toothpick and bend it in the exact opposite direction, removing the "set" and restoring the original set. But don't apply the restoring set all at once, and directly against the arrow in the figure. Rather, engage the sharpened tip of the toothpick between the 3rd and 4th loop of the hairspring and run it back and forth a few millimeters – maybe an eighth of an inch – *along* the spring, but angled very slightly outward. Magic! That spring, under the glass, is one of the most beautiful things you will ever see!

Or take Fig. 2b. By great good fortune, I managed to get something like this in the photograph. I was working left-handed at arm's length with a commercial photographer, tripod, Hasselblad, and speed-flash all between me and what I was doing. The only way I could tell that I was contacting the hairspring was that the meter needle quivered a little from time to time. See that little loop up past the outer turn of the hairspring? That's how it looks, except that it stays there by itself and hangs the meter movement up. Same remedy here: move the sharp tip of the toothpick a little further back this time until the spring jumps clear. Imagine you are petting a microbe; this will help you use a minimum of force. This, by the way, is the only trouble that ever clears

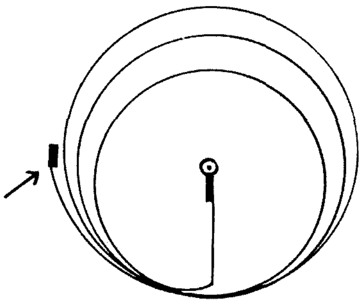


Fig. 2a. Spring is bent at outer attachment.

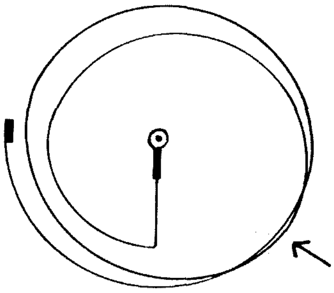


Fig. 2b. The outside loop is hooked over the spiral.

itself, and not very often, either. I think that slamming the needle is what does it. The sharp pulse sets up a standing wave that whips a loop of hairspring outside the spiral, where it catches.

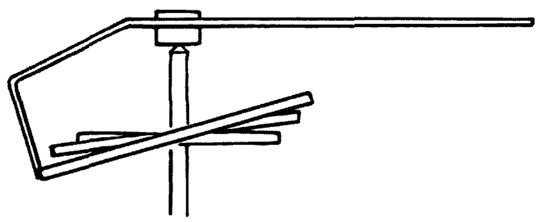


Fig. 3. This anomaly was probably caused by the downward motion of the adjusting fork.

Figure 3 is interesting, too. Obviously, someone has hit the scale end of the adjusting fork, pushing it downward. So take your tool and twist it back up. These "repairs" (adjustments) take five minutes of looking and five seconds of adjusting. Or five hours if you mess it up or "fix" the wrong thing. A good visual imagination is the secret. Of course, the examples illustrated are frequently encountered and basic. But if you get any two of them together at the same time, or even a third mixed in, then the others will be more obvious and can be cleared in their turn. I never said it was easy, but you can do it, nevertheless, if you look before you poke. Most people don't.

Consider: The hairspring is foil thin, it is made of phosphor-bronze, one of the toughest metals, perfect for the purpose. It *wants* to go back like it was. Both ends are soldered fast, which limits the degree of possible entanglement, a sort of antithesis of Murphy's law. The worst thing is kinking and this is also due to big, vulgar, ignorant thumbs getting into the hairspring. Even these can be straightened one at a time, and suddenly the hopeless case is perfectly okay. Some traces may remain, but if the spring is symmetrical, and the eye can't be fooled in this, then by all means *let it alone*! Once you have sufficient clearance, twice as much isn't better, and costs in another dimension.

Generally it is not necessary to remove the scale. Mount the meter level and secure – in a box, or something. If the meter slips and you make a grab for it and stick your highly-skilled thumb through the hairspring, it will have exactly the same affect as if the office oaf stuck his in. You won't feel any better, anyhow.

Once I got a meter in a tube tester that was supposed to stick. Impossible! It was a taut-band type, with pole clearances you could throw a cockroach through. I returned it and got it back, with the needle stuck this time. Out of the case, it came unstuck and no possible place to stick could be seen. By considerable mistreatment I managed to hang the needle up on a scale-screw. Bending the needle up a bit fixed things.

A funny one: a meter with no needle at all. I was offered affidavits that the case had never been opened, but still – no needle anywhere. What could I use for one? Broomstraw, inked? Broom? Push-broom!! I plucked a horsehair from it – perfect. However, I ironed it straight on the soldering iron, and dampness finally recurled it. I should have picked the longest and straightest and let it go at that.

How about calibration? You have restored the spring to its original shape, and very probably the calibration is pretty good. You can set the zero adjustment in the middle of the adjuster range by moving the *back* hairspring lever (be very careful of this one, the lever is short and you risk a Fig. 2a). Once you get the zero okay, how about full scale sensitivity? You could adjust the shunt or multiplier, or if you are lucky, there might be a magnetic shunt. This gadget is a thin leaf of magnetic material that can be slid across the poles to leak a little of the flux around the coil. For more sensitivity, slide it back over the magnet away from the pole. This forces more of the flux through the air-gap and coil, increasing sensitivity. Only the very best domestic meters have this feature. Hickok even had one around the *outside of the meter case* in the big Gm meter of one of their tube testers.

It is usually pretty disillusioning to calibrate or compare meters. It really shouldn't be, but even the best meters aren't as accurate as you think. If they were, they would be too fragile and expensive to use. We've been getting along with them very well for years, just as they are.

And if you have to fix one – good luck!

...WB2PAP

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EUROPE'S FIRST AND HIGHEST DX REPEATER

Imagine being able to use a 1W FM transceiver and work stations in West and East Germany, Austria, Czeckoslovakia, Yugoslavia, Italy, Switzerland and France! This range of coverage is available through the Zugspitze repeater located in the Alps in southern Germany. The Zugspitze repeater is probably one of the most unique repeaters yet to operate in the 2 meter band. Its story is an interesting one not only because of its location, technical details and the German amateurs involved but because it may well become the model for a number of DX repeaters located throughout Europe. So, although American amateurs won't be using this repeater, except perhaps when on vacation in Europe, its story should be of value and interest.

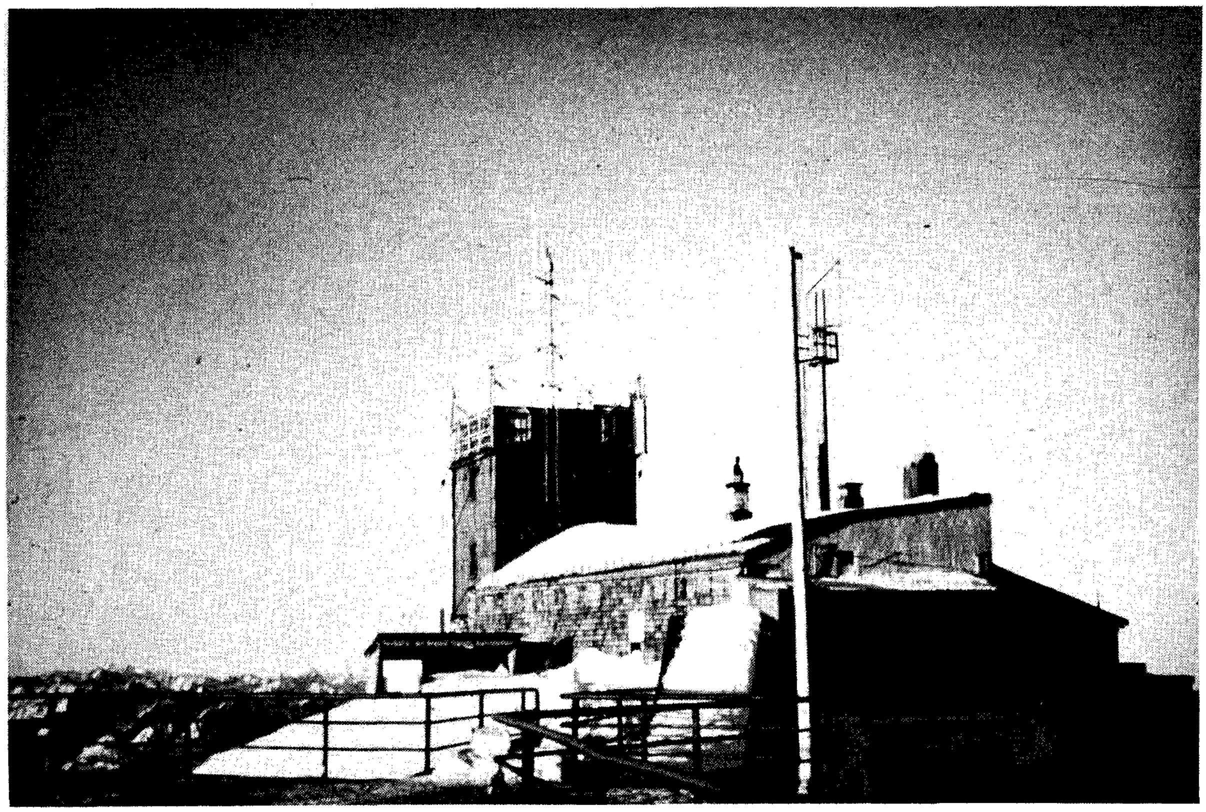
Before describing the history of the repeater itself, and unless one is familiar with southern Germany, it would be a good idea to take a look at a map of Europe and locate

A panoramic view from the Zugspitze Mountain.

the city of Munich in southern Germany. Within a radius of 200 to 250 miles coverage around Munich are located portions of all of the countries mentioned above. These countries cannot be worked directly from Munich because of lack of height, interfering terrain features, etc. However, if one proceeds southward from Munich, the countryside remains relatively flat to gently rolling hills until about 50 miles southward when one rather suddenly encounters the start of the Alps. A number of peaks rise to several thousand feet in height. One of the most famous of these peaks and one of the highest (9, 721 feet) is the so-called Zugspitze. It is not the highest peak in the Alps but it is the highest peak in the portion of the Alps which cover Germany and the peak is right on the border between Germany and Austria. A meteorological observatory as well as a hotel are located on the peak and the area is a favorite with skiers. The view of the Alps provided from the peak on a clear day is perhaps one of the most spectacular in Europe. It is reached by means of a rack and pinion railway (not too scenic because of all the tunnels it travels through) or by an aerial cablecar ride that is guaranteed to fascinate anyone.

When the 2 meter FM repeater idea began to catch hold in Germany it was natural that the amateurs in Munich looked toward the Zugspitze because of its high location and its accessibility. Approaches were made to the Bavarian Weather Service which maintains the weather station on the mountain to be allowed to set up a repeater on top of the weather instrumentation tower. After some rather difficult sessions with the weather service people, the German amateurs involved in the project finally did obtain permission to set up the repeater. Some of the conditions involved were rather hard to take, however. For one thing, the repeater installation could not be located indoors but had to be contained in a metal enclosure outdoors. Only a power line to the repeater, which would be metered and separately charged for, would be provided. Also a liability insurance policy in the amount of some $250,000 had to be taken out to insure that should the installed equipment, antennas, etc., cause any damage to the weather installation or to a person (there is a tourist observation platform around the weather station) that the weather service would be protected.

It required considerable determination on the part of the amateurs involved to forge ahead under these conditions, especially since at this point the financial support for the project would have to come solely from the amateurs themselves. It might be worthwhile at this point to mention that although only a few amateurs did all the work on the project, all amateurs can use the repeater. Private or "closed" repeaters are simply not allowed on the 2 meter band in Germany. The makeup of the repeater channels in Germany has been described in other articles and so it won't be gone into in great detail here. But either because of the Teutonic characteristic for having everything done by a rule book or because German amateurs saw the mess that was developing about repeater frequencies in the U.S., when repeaters were first authorized in Germany specific channels were set up for their usage. Only these channels could be used and every new

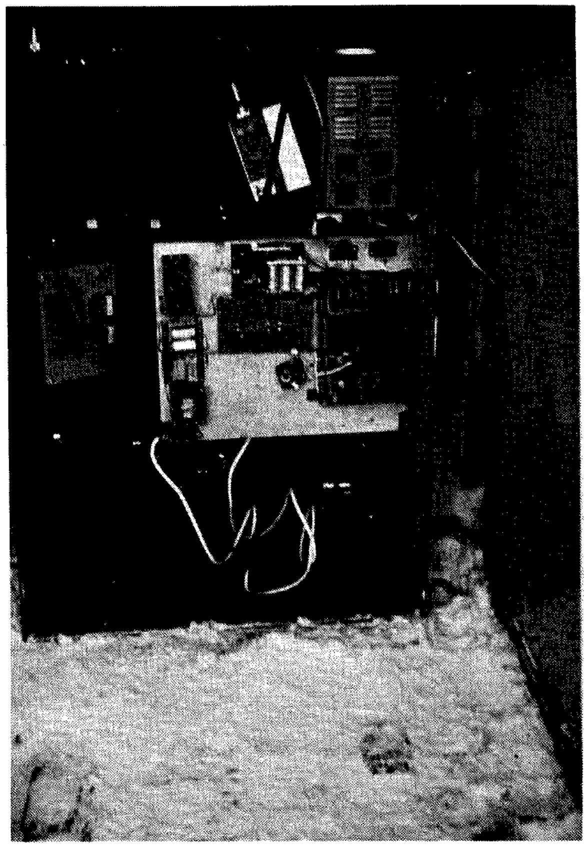


A view of the weather station on the Zugspitze. The transmitting and receiving antennas are directly above and below the tubular structure on the right side of the tower.

repeater that was set up had to use a channel that would be compatible with other nearby repeaters. Originally 3 channels for repeaters were allocated and this now has been expanded to 7 channels. The input channels for repeaters are in the range of 144.15 to 144.30 MHz with 25 kHz spacing and the output range is 145.70 to 145.85 MHz. Repeaters can have a maximum power of 15W and ±5 kHz deviation. To enter the repeater initially a tone burst of 1750 Hz is required (most will also whistle-on) and then the repeater is carrier keyed as long as no break of more than 3–5 seconds occur. The amateur licensed to operate the repeater also has to be able to remotely disable and enable it. However, a separate link is not required and this control function is done by a multiple tone signal on the input frequency of the repeater.

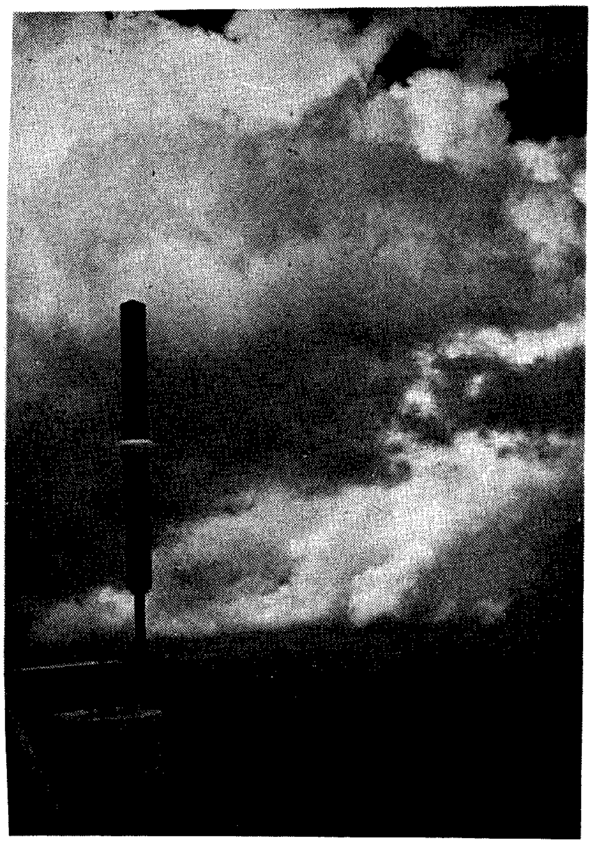
There were many amateurs in Munich who contributed to the establishment of the Zugspitze repeater, but the leading members of the team were Sepp DJ9HJ, Bernd DL9ZD and Peter DJ3YB. This team was perhaps an ideal one for such a project because of their complementing interests and talents. DJ9HJ headed the organizational aspects of getting the repeater established while DL9ZD specialized in digital and control circuits and DJ3YB was an experienced engineer on VHF/UHF circuitry.

After receiving the necessary license for the initial Zugspitze repeater in the spring of 1970, the Munich team set about to assemble the necessary equipment to get the repeater into operation as quickly as possible. The emphasis at this point was to get the repeater into operation during the good weather period. Fortunately a commercial VHF transceiver intended for mobile use could be secured, and with the necessary modification for a power supply, frequency changes, a keyer for repeater ident, etc., it formed a repeater "package." Two completely sealed vertical dipole antennas of commercial design and a cavity filter made up the antenna part of the package. After initial testing, the entire package was trans-



The original Zugspitze repeater housing. The entire repeater is located outdoors.

ported to Garmisch, Germany, in August 1970, where it was loaded on the cable car for transport to the Zugspitze. The station package except for the antenna had been assembled in a metal container intended to remain outdoors. Over a day was required for the initial setup of the repeater and all of the usual Murphy's laws applied, as it was found the metal container was too large for the space it was meant to occupy, etc. None of these problems would normally have caused great concern except that one had to work at 9,000 feet elevation and rides up and down the cable car were costing up to $15 each because of the equipment that had to be transported. Finally the repeater was set into operation and amateurs in southern Germany began to enjoy a unique repeater operation – but for only eight days. Then the repeater seemed to malfunction as the receiver sensitivity was greatly reduced. The cause was traced to the cavity filter used for antenna isolation. It had been constructed from 1 mm thick copper but apparently this



A view of the transmitting antenna in summertime. The antenna is a completely weather-sealed vertical half-wave radiator.

thickness could not remain properly adjusted due to the temperature extremes encountered on the mountain. A look in the statistical records showed that the temperature on the Zugspitze, to which the entire outdoor installation would be exposed, varied from -37 degrees to +70 degrees. The average temperature is about 24 degrees, the same as that for Greenland. The problem with the cavity filter could not be solved, but an anonymous donor came up with a commercial 5 pole filter that did the job.

After solving the filter problem, the repeater basically continued in operation with only minor difficulties. The transmitter used was a tube type and had only 5W output. Nonetheless, German amateurs were pleasantly surprised to find at times Italian, Czeck and other DX stations calling over the repeater. Also, the coverage achieved in Germany was considerable, with stations being worked up to Kassel in northern Germany. The unpleasant side of thepicture was that the repeater was starting to inter-

The transmitting antenna after a winter storm. Temperatures easily drop to -37°

fere with almost every other repeater in Germany operating on the same channel. Since the Zugspitze at this time was set up to be a part of the overall German repeater network and not a special repeater, the interference problem with other repeaters had to be solved. The obvious solution was taken of reducing the transmitter power to a little over ½W. This power level still provided more than adequate service using the repeater throughout most of southern Germany and the repeater functioned in this manner throughout 1971.

However, the vision had certainly been created in the minds of the Munich amateurs as to what could really be done with the Zugspitze repeater if it was brought up to full power level and allowed to operate on a clear channel. A reorganization of the German repeater network channels in late 1971 made provision for the Zugspitze repeater to be set up on a separate clear channel (enter on 144.275, receive on 145.725) and planning was started on completely re-equipping the repeater.

The team of DJ9HJ, DL9ZD, DJ3YB and other Munich amateurs again got together and decided that rather than try to refurbish the old repeater equipment to build a completely new installation using high performance equipment and specifically designed for the environment found on the Zugspitze. Although by now there appeared to be some hope of getting the radio clubs in the southern Germany area to help defray the cost of the equipment, the initial expenditures were totally those of the individual amateurs concerned with the project. The equipment designs that evolved for the new Zugspitze DX repeater would deserve several articles in themselves to describe it all completely. The equipment was totally home-brewed, but with a quality I have seldom seen matched in the finest commercial gear.

Basically the total equipment package fits in a container about 2' x 1½' x 2" high and consists of the antenna filter, receiver, transmitter and control and call-sign identifier. Each unit has been tested in an environmental chamber to simulate the extreme conditions encountered on the mountain. The receiver consists of a FET input rf amplifier stage working into a mixer using four HP2800 hot carrier diodes to translate the signal frequency down to 10.7 MHz. At 10.7 MHz several crystal filters are used to achieve a 20 kHz bandwidth and then a phase-locked loop circuit is used as a FM demodulator. The noise figure of the basic receiver is slightly over 2 dB and the noise figure of the entire receiver side of the repeater including the effects of the antenna isolation filter is 3.5 dB. The squelch sensing circuitry operates on a dual frequency sampling basis to guard against accidental trip by stray interference. The transmitter side of the repeater, which is also fully transistorized, produces 15W output. In order to avoid the generation of many spurious signals which is usually the case when one starts with a low frequency crystal and multiplies it up to 144 MHz, a different frequency generation scheme was used. This was considered useful because the transmitter had to operate so closely to a very high performance and sensitive receiver. Figure 1 shows the transmitter frequency control scheme. A Voltage Controlled Oscillator

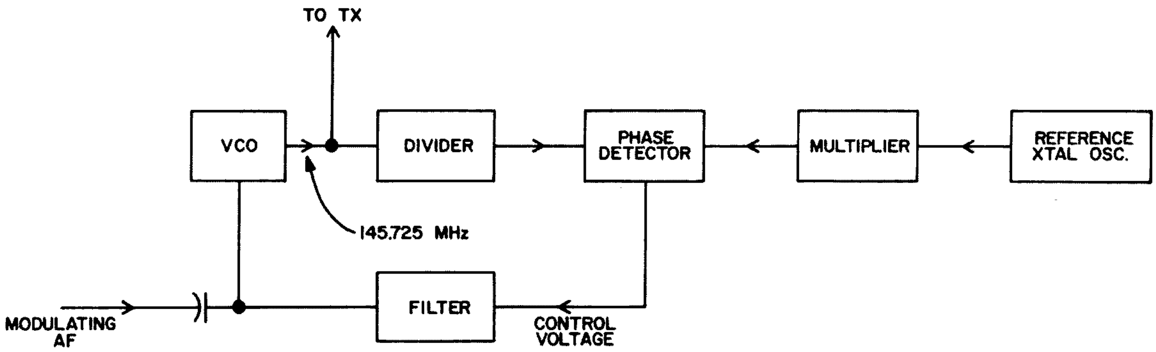


Fig. 1. Principle of operation of transmitter frequency control system.

operating directly at 145.725 MHz is used. The output frequency is divided down and then compared in a phase detector with the frequency of a reference crystal oscillator which has been multiplied up in frequency. The resultant difference control voltage from the phase detector is used to control the frequency of the VCO. The VCO is directly FM modulated by an audio signal, the control voltage from the phase detector being made slow enough not to react on the modulation. The control, alarm and call identifier chores are taken care of by circuitry consisting of some 24 IC's from Texas Instruments. The call repeater works on a shift register principle and is timed to send the call (DBØZU) every 80 seconds. If the transmitter has not been keyed by a user, the transmitter is turned on just for the duration of the ident. Normally, a tone burst of 1750 Hz is necessary to key the repeater. It then remains carrier keyed for 15 seconds after which the tone burst has to be repeated. If someone should open the repeater just as it is about to identify itself via F2, the ident is skipped until the next 80 second period. This is to prevent the call from a weak DX station being obscured by the repeater identifer signal.

The subject of the antenna to be used with the new repeater was often debated. Since the new repeater was intended primarily as a DX repeater, the idea of horizontal polarization became popular since the repeater would be primarily used by home stations. However, this idea was eventually dropped and it was decided to leave the repeater with vertically polarized antennas so mobile stations could also easily use the repeater. Furthermore, since the antennas already installed performed without failure, it was decided to leave them in operation for the time being. The only fault with the present antenna installation is that as one can see from one of the photos, the receiving antenna is partly shadowed by a portion of the weather tower. The ultimate plan is to use only one antenna for both transmitting and receiving which would be elevated to clear all obstacles. A form of ferrite circulator will be used to isolate the receiver and transmitter rf circuits. Such circulators are economical and provide up to 50 dB isolation but are quite critical as to proper termination. Damage to the antenna, for instance, which causes the swr to rise, would destroy the isolation characteristics. However, that plan belongs to the future as well as the one to have the receiver bandwidth automatically controlled by the strength of the received signal – smaller bandwidths being used for weak stations to increase intelligibility.

The Zugspitze DX repeater was installed in May of 1972 and has been fulfilling a repeater user's dream. Records will still be in the process of being set for some time as to how far away DX can be worked in the various countries the repeater signal covers. The debate also goes on as to whether DX via a repeater is really DX at all. But whatever might be said there is no denying that working various countries via a repeater couldn't be more fun. The Zugspitze repeater will most certainly open up new thoughts and challenges for the usage of repeaters for years to come.

. . .W2EEY

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A BALANCED DIPOLE ANTENNA

The antenna described displays the following features: rf balance to ground; lightning protection; low loss ground system; multi-band capability; and simple erection procedure.

Over the years I have erected a large number of 80 meter dipole antennas embodying a great variety of mechanical and electrical arrangements. Out of these multiple experiences have come a fair number of features which might qualify as "good" practice.

It is the purpose of this article to describe a readily erected dipole system which combines excellent performance with unique electrical and mechanical features.

First, I wanted the radiating efficiency to be high. Secondly, since the use of this dipole in a phased array was contemplated, a predictable dipole field pattern was desirable. This required good electrical balance at the feedpoint and a uniform ground system.

Third, since I have had enough good luck for one lifetime regarding lightning damage (none) I wanted the sides of the dipole to be directly connected to ground for dc at all times.

Fourth, since I am addicted to antenna experimentation, I wanted the ends of the dipole to be readily accessible for length adjustment and the entire structure easily taken down for major changes.

In addition, why not add 40 meters?

The principal radiation from such a dipole is in a plane perpendicular to its direction; the polar plot of field strength is essentially a circle tangent to the surface of the ground. Thus, the radiation is concentrated at the high angles, near the vertical. The desirable low-angle radiation will increase as the height of the antenna is increased. In addition, the losses in the antenna and in the ground are decreased as the height increases.

An effective compromise between operating results and cost of the installation normally calls for a height of about 40 to 60 feet. Greater height is desirable but expensive, whereas at lower heights the efficiency and the pattern shape become unacceptable.

It turns out that the five-section telescoping TV masts, available in the popular TV supply stores for about $20, are satisfactory for supporting the center of the dipole at a height of 45 feet. This mast can be assembled on the ground and walked up or hoisted to a vertical position. If clamped against a house or other structure at about the 15 foot level the mast need only be guyed at the top, even in the strong winds of the Rochester area.

The two halves of the 80 meter dipole serve as top guys in, say, the north-south directions, and the two halves of the 40 meter dipole (with a common coaxial feed line) double as east-west guys.

For ease of erection the mast is pivoted at its base. This base support is a 5 foot length of 1-1/2" diameter galvanized steel tubing projecting 1 foot above the ground. A 5/16" bolt through the post and mast provides the pivoting shaft. The side of the mast is

hacksawed diagonally at the base to clear the supporting post.

The coaxial feed line for the dipoles is inside the mast; this decreases wind problems and also serves to shield the outer sheath of the coax from unwanted rf coupling.

A balun coil arrangement is frequently used to assure balanced currents at the center of a dipole antenna. In the present instance a novel method is used which not only provides the required balance to ground but which also offers a low-resistance dc current path to ground from both sides for lightning protection.

The mast itself forms the outer conductor of a coaxial section having the sheath of the feedline at its inner conductor. The length of this coaxial section inside the mast is approximately one quarter wave length. Therefore, if the shield is shorted to the mast at its base, the impedance viewed from the top will be high so that it can be connected across the center feed point of the dipole without appreciable loading. This unorthodox arrangement is completed by connecting the center conductor of the coaxial feedline directly to the top of the mast! One half of the dipole antenna is connected to this common point, the other half to the shield and, to relieve the suspense, it works fine! The arrangement provides dc current paths to ground for lightening protection of both sides of the dipole and it achieves balance of antenna currents through its balun action.

The rf transmitting currents in either half of each of the dipoles are conveniently indicated by means of four flashlight bulbs, not shown in the figures. Each bulb is shunted across a 3" length of the antenna wire just outside of the top insulator. A 3" length of #18 copper weld wire is used from each side of the bulb so that the latter is soldered in place at a corner of a 3" equilateral triangle. This area of pick up loop gives adequate brillance for tests without burning out the bulbs. The equal brillance of the two 80 meter bulbs, for example, provides an excellent indication of the balun action of the unorthodox mast connection used.

In order to insure a stable dipole pattern with symmetrical ground reflection and to

reduce ground losses, a grid of nine parallel ground wires, each approximately 200 feet long, spaced ten feet apart, was buried under the dipole parallel to its plane. A single cross-buss was placed across the middle of the grid and soldered at the cross-over points. The base support of the antenna mast was connected at the center of this ground system.

The clamping hardware supplied with the mast was discarded. The mast was extended horizontally on blocks on the ground and the overlapping sections were secured against vibration by us of #18 self-tapping screws. The mast was painted to discourage rust; the color was chosen to match the shutters of the house in a gesture toward community harmony.

The antenna wires and the coaxial feed line are supported at the top of the mast by a cylindrical plastic insulator. This insulator, which combines high strength with low wind resistance, is made by sawing off the grooved male portion of a "T" fitting for plastic water pipe. There is a size which is a snug push fit over the 1-1/4" o.d. mast. The grooves serve to anchor the wires and they also provide an improved leakage path for rf currents.

The details of the insulator assembly are shown in Figs. 1 and 2. All wires are #12 stranded copperweld. The "D"-shaped wire loops pass through the insulator, one above the other, as shown. There are no screw connections to loosen or corrode and, of course, all connections are twisted and soldered. A radiator hose clamp holds the insulator in place. The RG-8/U coaxial feed

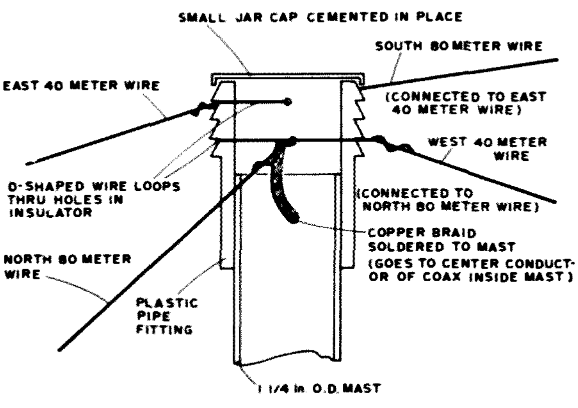

Fig. 1. Top insulator – side view.

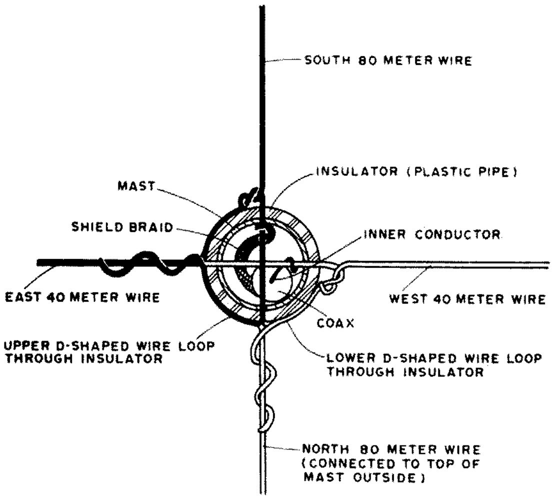

Fig. 2. Top insulator – top view.

line is supported from the "D"-loops, centrally within the mast. (This feed line is cut to be a multiple of a half wavelength – approximately 82' 2" for a 3.955 MHz.) A noise bridge is used for this and all other resonance measurements.

The mast was hoisted to the vertical position using an inexpensive 4-pulley rope hoist attached at the 16' height. After erection the mast was clamped to the house roof at the 15' level using a steel strap and lag screws.

The four halyards at the end of the antenna wires are of 1/8" nylon rope. These are supported by 2-1/2" diameter galvanized posts seven feet high. These posts are each located at a distance of 80 feet from the base of the mast and are connected to the ground system. The ropes are secured by swivel snaps attached to the tops of the posts, for ease of lowering for antenna adjustments.

The dipole was adjusted to resonance, using a noise bridge, by adding equal lengths at either end. Resonance was achieved at 3.955 MHz with a length of 120' 9" and an input resistance of 50Ω.

The SWR of the antenna is quite low (approximately 1.01:1) and its response is sufficiently broad to cover the 80 meter phone band without appreciable decrease in signal strength.

Results on the air have been excellent and it is a pleasure not to have to ground the antenna during lightning storms.

. . .W2OZH

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DIGITAL "HI" GENERATOR

Probably one of the most used greeting or expression in amateur radio be it a car with call letter plates passing another, or the passing of an OSCAR satellite overhead, is the simple world, "HI." I do not know how it all started but I know that if I want to greet another ham on the road, I want to honk "HI." Therein lies the problem. My car is one with the horn incorporated in the steering wheel rim, and it is next to impossible to honk any kind of code, much less the rapid succession of four dots and then two dots. This prompted me to design a circuit which will digitally produce the word "HI." The scope of this article will be to describe the basic digital "HI" generator, which can be used in any application desired by the addition of the appropriate output keying stage.

Figure 3 shows a typical output stage which can be used to key the horn relay of a car. In this application, the driver would be simply required to touch a momentary contact push button type of switch and the "HI" generator will start and self-complete the word "HI." This circuit uses a total of four integrated circuits and eight discrete components, and when built will easily fit in the palm of your hand.

Referring to Figs. 1 and 2, a unijunction transistor oscillator located on plug-in-board

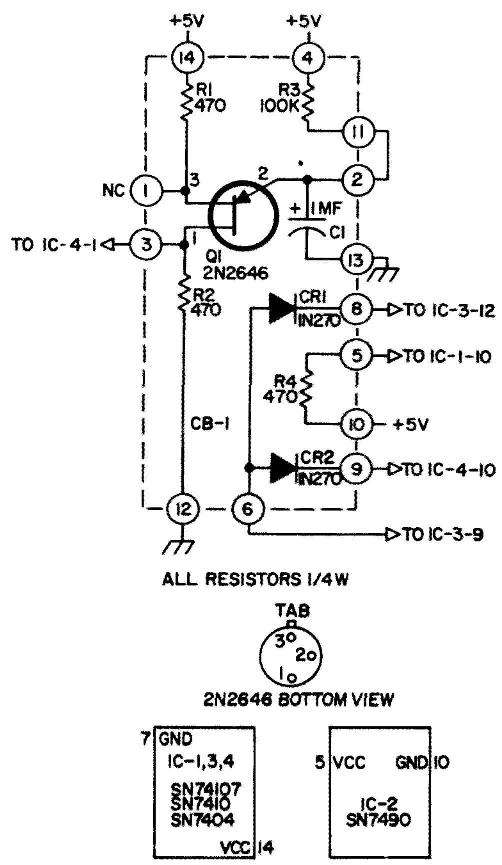


Fig. 1. "HI" generator.

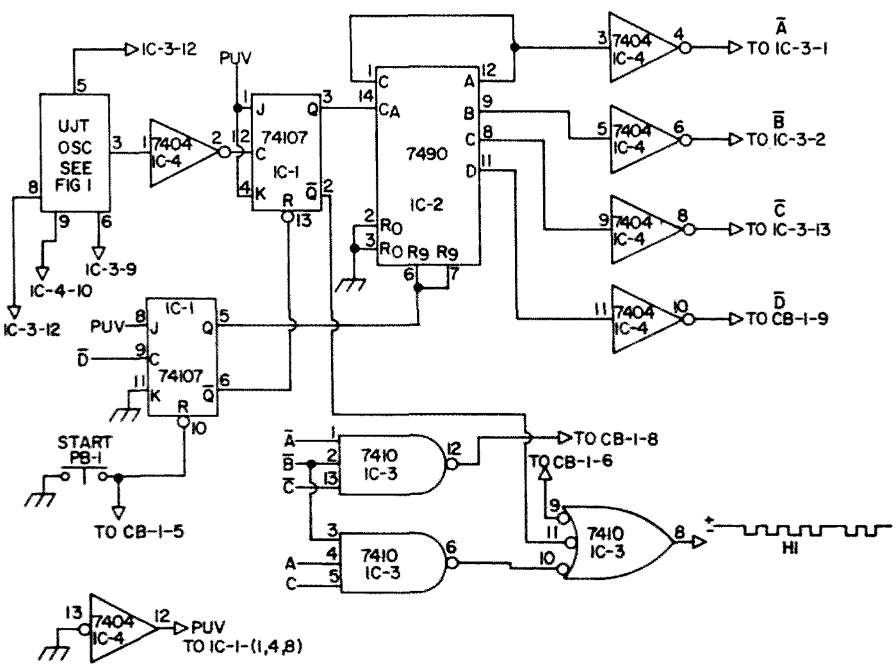


Fig. 2. Basic "HI" generator.

CB-1 generates a timing pulse which is fed into a 7404 inverter (IC-4-1) and is shaped and inverted to form a narrow, negative-going pulse. This pulse is fed into a JK flip-flop (IC-1) which, when allowed to run by the setting of the "run" flip-flop, acts as a divide-by-two counter whose output is a symmetrical square wave. This square wave, which will be referred to as the clock term, is wired to two locations. The first location is the clock input of the SN7490 decade counter that "counts" the clock pulses, and the second location, the output gate, (IC-3) which uses the oppose phase or $\overline{\text{clock}}$. This term is simply the $\overline{Q}$ side of the clock flip-flop. The purpose of the $\overline{\text{clock}}$ term driving one input of the output gate is to chop anything passing through this gate into a series of dots. Since this gate, as described thus far, will produce an endless string of dots, all we have to do is inhibit the unwanted dots and we will have the word

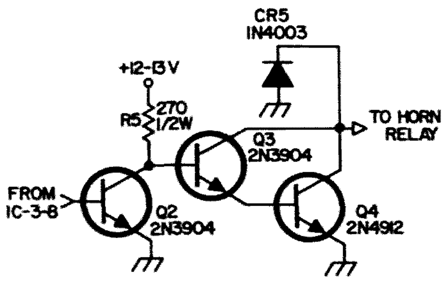
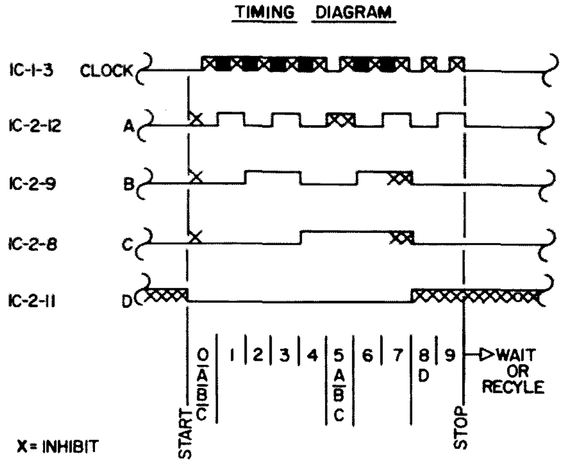


Fig. 3. Typical output stage that will key the horn relay of your automobile.



"BEEP" OUTPUT INHIBIT $= (\overline{ABC}) + (A\bar{B}C) + \text{CLOCK} + D$

OR

OUTPUT $= \overline{\text{CLOCK}} \cdot (A\overline{BC} + \bar{A}B\bar{C} + AB\bar{C} + \bar{A}BC + ABC + ABC) \cdot \bar{D}$

Fig. 4. Timing diagram.

"HI" remaining. Referring to the timing diagram (Fig. 4) it will be noted that to form the word "HI" we must get rid of count zero, count five, and counts eight and nine. To do this we do not need to decode all bits; all we need is enough information to electrically describe the period we are interested in. You will see that count zero has a unique condition when terms A, B, and C are all low. These three terms are inverted by IC-4 so as to provide the high level needed for the 7410 to decode an AND condition of $\overline{A\,B\,C}$. In the same manner, the count of five is decoded using the terms A, $\bar{B}$, and C.

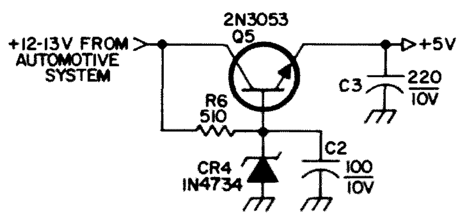
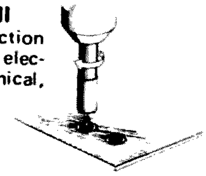


Fig. 5. 5V automotive power supply for the "HI" generator.

Since we do not want counts eight or nine, we use the term "D" which occurs only during these counts, to directly inhibit them. A secondary function of this term is to reset the "run" flip-flop back to the waiting state. So we can now say that we will have an output key unless $\overline{\text{clock}}$ is low *or* $\bar{D}$ is low *or* zero decade is present *or* five decode is present. Add this all together and all that is remaining is . . . . . . "HI."

. . .WA6JMM



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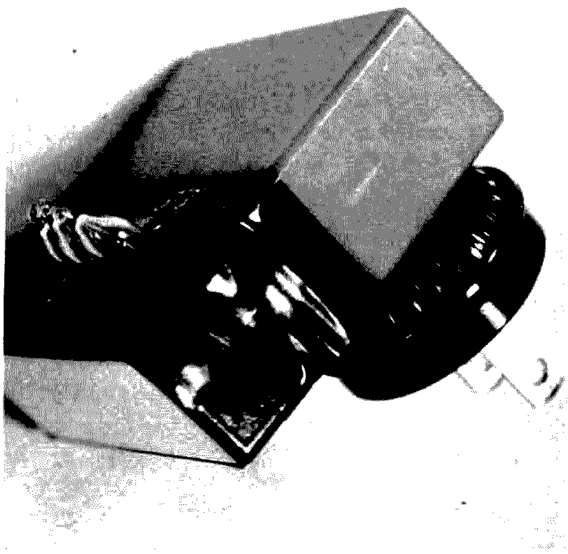
A THREE-STAGE OSCILLATING RING COUNTER WITH INDICATING SHIFT REGISTER

In past months amateurs have swung to an increasingly large-scale utilization of digital circuitry in the myriad of applications borne by the creative inventiveness inherent to the minds of lazy men. Finding an easier way to get the job done is a cardinal rule among amateurs which often, alas, requires staggering amounts of brainpicking and midnight oil burning.



Being a newcomer to the digital circuitry field, I diligently applied myself to the job of relearning an old hobby. It was in the midst of one of these study sessions that it occurred to me that a venture into an interdisciplinary approach could be profitable.

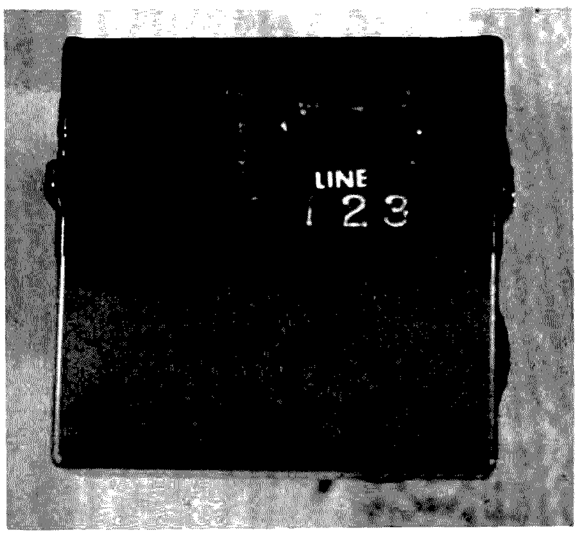
My friends, if you think this a fiction penned by somebody's relative from "Feenix, Arix," please bear with me. I am going to describe an amazing circuit shortly, but I feel there is much to be learned from the kind of thinking that led to its discovery.

The radio circuits developed in vacuum tube days are mostly analog devices producing unquantized outputs (on a macroscopic scale) proportional to their inputs. One of the greatest tools ever developed for analog circuits was the concept of feedback.

Feedback gave us greater sensitivity in our detectors when we made them oscillate; remember the old super-regenerative rigs? Another form of feedback led us to develop automatic everything control circuits. And do you remember reflex amplifiers?

Negative Amplifiers

Circuit designers applauded the development of the tunnel diode because it exhibited a negative resistance region. Fifteen years ago the easiest place to go for a negative resistance region was a neon lamp. In addition, we could make neon bulbs sensitive to ac, dc, rf, light levels, static, radiation, or body capacity. And an NE-2 is a pretty compact little unit.



By taking advantage of the negative resistance region of the NE-2 in digital circuitry, we can design into a simple ring counter of a few stages many of the sensitivities of the neon bulb if we correctly choose our operating parameters. We can further sensitize the circuit by many of the tricks we learned in analog days: oscillation, feedback and reflexing. Further, we can sensitize and balance the stages to the point where environmental factors can influence the behavior of the active elements, warping the count. And finally, since the neon bulb is kind enough to glow for us at certain segments of its nonlinear operation, we can utilize it to indicate visually when shifting occurs.

The Circuit

The schematic for the three-stage oscillating ring counter with indicating shift register that resulted from my experimentation is shown around here somewhere. A simple line-operated half wave rectified power supply is included for simplicity and ease of operation. R1 is a current-limiting resistor to prevent damage to the NE-2s and to help make the counter balance less critical.

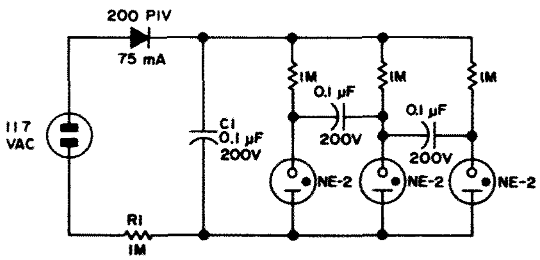


Fig. 1. Schematic diagram of the TSORC/ISR.

C1 is included to slow the circuit shifting to a reasonable rate and to help, or at least to try to help, prevent the circuit from running away as it oscillates in and out of balance.

Match the three remaining 1 meg resistors fairly closely. I got away with using 5% off-the-shelf units. The lamps should be matched and mounted adjacent to one another, with the six electrodes aligned.

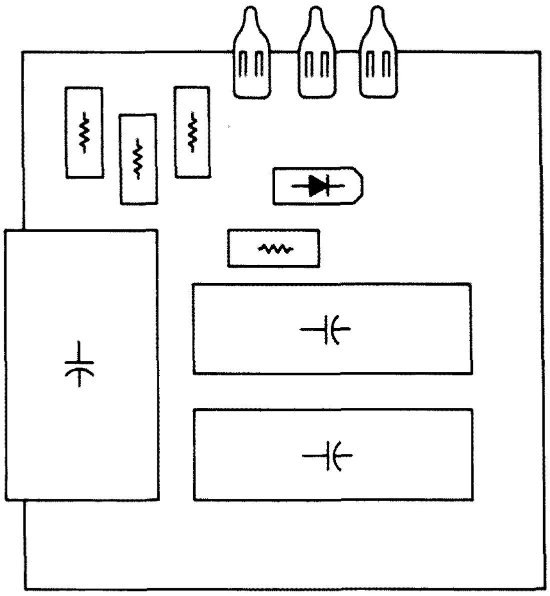


Fig. 2. All components were mounted on one side of a small (1½" x 1¾") piece of perf board. All wiring was done on the bare side of the board, using sleeving where needed.

The simplest test of the circuit is to assemble it and attempt operation at room temperature under normal lighting and radiation conditions. A properly-operating unit will flash in a sequence of 2-1-2-1-2-3-2-1-2-1-2-3.

Once the correct pattern has been established, age the unit by allowing it to operate unattended for about thirty hours. During this time, the kids will get a big kick out of watching the lights blink.

After aging, the unit is ready to function as a eutectic digital-human interface device, not dissimilar to Spock's Tricorder on the fictional program Star Trek. Readout is by means of variation in the basic flash pattern.

The TSORC/ISR, despite its tremendous versatility, has no capability for memory, as do its big second counsins at IBM. Although I have explained its operation rather fully, I have not dealt with the problem of programming the unit. If I receive enough requests, I will include a short article on the programming of the TSORC/ISR in a subsequent issue.

. . .Weinstein

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FREQUENCY MULTIPLICATION THE EASY WAY

Multiplying to 2m with transistors is easy if you take the correct precautions.

This article is not only a construction article but also explains some of the things that can happen when you set out to build a frequency multiplier from scratch.

You might say multipliers are easy because you don't have to worry about feedback when the input is on a different frequency than the output. True enough, but that's not all the story. Let me quote from RCA's *Transistor Manual SC-14* the chapter on frequency multiplication: "Various types of instabilities can occur in transistor frequency multiplier circuits, including low-frequency resonances, parametric oscillations, hysteresis and high frequency resonances." Hysteresis refers to discontinuous mode jumps when either the input power, frequency, or both, is increased or decreased. And, "The transistor may behave as a locked oscillator on the fundamental frequency." Further, on VHF or wide-band circuits, "Unless the builder has had considerable experience with these types of circuits, he should not undertake the construction of such items." That's all very well and true to an extent, but it is the same old story; how are you ever going to *get* that experience if you don't make a start? So here is some help. After half a century in radio I am still learning every day (pretty poor day when you don't) and this is what I've already learned this year about frequency multipliers:

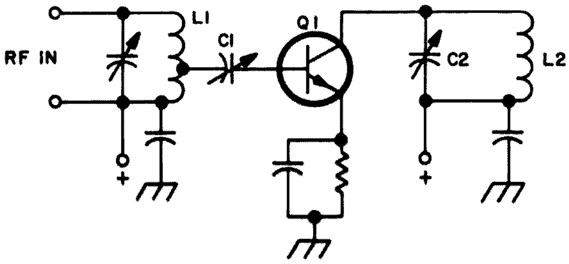

Fig. 1. Schematic of "trouble" circuit. (Do not build.)

The project calls for high gain because you're out for power while multiplying. It is always pleasant if you can get it. The more power you have in each stage, the less liable you are to have reaction or feedback into that stage from the final output stage. This is very important when you try for power like 25W, and some people are already working on 500W output power on Two!

A two-stage IC FM modulated, low-power source was used to drive the input on 24.5 MHz. This oscillator's output was kept low for stability purposes, which didn't make things any easier to start with, but it is now working very well. The whole project delivers some 1–1.25W output on 147 MHz with good, smooth and easy tuning – no jumps or other troubles.

Figure 1 shows the complete multiplier circuit *first* as a guide, because in the past some readers have built a wrong circuit that was illustrated to show what *not* to do. Figure 1 is one of these. Troubles which occurred during design work are thus shown in Fig. 1. Do not build *this circuit*! The first thing I did was to use the wrong transistor. I have several new, "hot" types, so of course in they went! You need high gain – go ahead! Trouble and plenty of it showed up right away. Now this is a perfectly good circuit and can be found in most manuals. *But*, a fantastic set of unwanted spurious oscillations showed up which clobbered the oscillator drive, and Q1 took off on its own,

even with the drive removed. After fighting it for a day or so, putting in a trimmer for C1 and changing transistors, it was better, but finally I found the cause: The lower half of L1 (in Fig. 1) from the tap to the cold end resonated beautifully and maddeningly with C1 and the base of Q1, producing a base-tuned collector oscillator on 147 MHz. This is not a good circuit even when used intentionally.

The Cure

This also is not a "new" circuit, the idea being to show when to use one or the other in order to do the right thing the first time. At *73* we *try* to help, because in our society today there just isn't all that time available, and this little story can save you some of that precious time. Putting a large capacitor, C3, from ground to base is the solution. Then the base of Q1 does not resonate on 147 MHz, and C3 also acts as a low pass filter unit to stop oscillation at 147 MHz. The incoming 24.5 MHz is resonated by L1 and C2, now referring to Fig. 2, the correct schematic, with the ratio of C2 and C3 dropping the impedance down to match the base of Q1. C3b is added to C3 for this purpose. You will find the tuning with C2 and the matching with C3 to be very smooth. Q1 is a 3866 which is always a good multiplier and does a good job up to 450 MHz. In this case it is used as a tripler to 73.5 MHz. I can assure you that it or the Motorola equivalent (for medium power usage), the HEP 75, will always do a good job of multiplying for you – all the way to 450 MHz. The collector of Q1 is connected to the top of L1, which is tuned to 73.5 MHz by C4, with C5 matching into the base of Q2 in the same manner as the input to Q1.

An rf choke coil is added to the base of Q2 to keep the gain up. No plus voltage was needed on the base as there is plenty of drive from Q1. Always check this to be sure. No emitter resistor was needed either. Be sure to check this, too! I always have a lot of external pots lying around, 500, 5,000 and 50K, and lots of clip leads for them. Very useful. Q2's collector output is tapped down on L3, as these 3866's have a low collector impedance when being pushed for output, which is what we are doing here. The output, tuned to 147 MHz by C6 and L3, is also tapped down on L3 and matched to the cable by C7. There is about 200 mW of rf here, which lights a No. 48 bulb nicely. You will find the circuit as shown in Fig. 2 is very smooth in tuning and reliable, and will handle 1 or 2 MHz without retuning.

The 1W Amplfier

With 1W you can begin to talk through several repeaters in your area, so we put a little time in on an amplifier for this purpose. Figure 3 shows this unit with a 2N5913 RCA transistor, one of their newer and livelier devices designed for this work. A cable input is shown, but this may be eliminated along with either C7 of Fig. 1 or C1 of Fig. 1, as the two series capacitors are

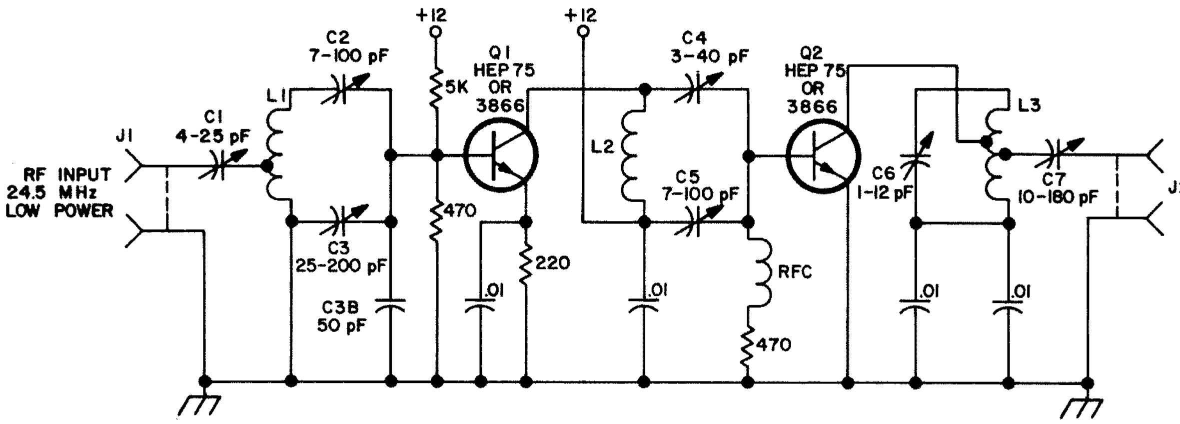

Fig. 2. Schematic of the 25 to 147 MHz multiplier. L1 – 20 turns No. 26 on 0.5 cm diameter form, length 1 cm. tap at center; L2 – 8 turns No. 22 on form 0.8 cm diameter, winding is 0.8 cm long; RFC – 25 turns on form 0.5 cm diameter, 1.8 cm long.

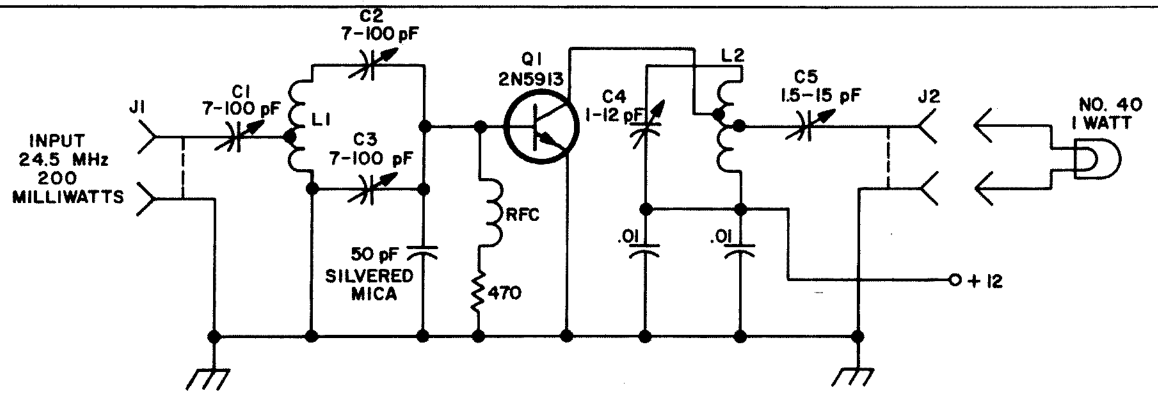

Fig. 3. 2 meter FM amplifier that will deliver 1W output. L1 — 5 turns No. 20, 0.8 cm diameter, 2 cm long. Input tap at 1½ turns from low end; L1 — same as L1 with collector tap at 1½ turns and output tap at 2 turns from the low end; RFC — 25 turns No. 30, on phenolic form, 0.5 cm O.D., 1.8 cm long.

not needed together. The base of Q1 in Fig. 3 is treated in the same way as the multiplier, and responds equally well – C2 and C3 being the impedance matching network. While not critical, the best power output is obtained at the correct tap. I used a No. 40 lamp for a 1W load through C5, and this can be lit to about 1.25W brilliancy with everything working right. Even though the 2N5913 is a pretty hot item, when loaded it handles well without self-oscillation and does a great job.

Conclusion

So here is a good straightforward project which is very handy to have around. I use it for transmitting exactly 600 kHz lower than the receiver in combination with a 10.1 MHz crystal. But that is another story . . .

. . .K1CLL

FCC RULES AND REGULATIONS, FART 97 (V)

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

CONTENTS THIS MONTH

Subpart D—Operating Requirements and Procedures

GENERAL

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SUBPART D—OPERATING REQUIREMENTS AND PROCEDURES

GENERAL

§ 97.77 Practice to be observed by all licensees.

In all respects not specifically covered by these regulations each amateur station shall be operated in accordance with good engineering and good amateur practice.

§ 97.79 Control operator requirements.

(a) The licensee of an amateur station shall be responsible for its proper operation.

(b) Every station when in operation shall have a control operator at an authorized control point. The control operator may be the station licensee or another amateur radio operator designated by the licensee. Each control operator shall also be responsible for the proper operation of the station.

(c) An amateur station may only be operated in the manner and to the extent permitted by the operator privileges authorized for the class of license held by the control operator, but may exceed those of the station licensee provided proper station identification procedures are performed.

(d) The licensee of an amateur radio station may permit any third party to participate in amateur radio communication from his station, provided that a control operator is present and continuously monitors and supervises the radio communication to insure compliance with the rules.

[§ 97.79 headnote and text revised eff. 10-17-72, and (d) further revised eff. 12-1-72; VI(72)-1]

§ 97.81 Authorized apparatus.

An amateur station license authorizes the use under control of the licensee of all transmitting apparatus at the fixed location specified in the station license which is operated on any frequency, or frequencies allocated to the amateur service, and in addition authorizes the use, under control of the licensee, of portable and mobile transmitting apparatus operated at other locations.

§ 97.83 Availability of operator license.

The original operator license of each operator shall be kept in the personal possession of the operator while operating an amateur station. When operating an amateur station at a fixed location, however, the license may be posted in a conspicuous place in the room occupied by the operator. The license shall be available for inspection by any authorized Government official whenever the operator is operating an amateur station and at other times upon request made by an authorized representative of the Commission, except when such license has been filed with application for modification or renewal thereof, or has been mutilated, lost or destroyed, and request has been made for a duplicate license in accordance with § 97.57. No recognition shall be accorded to any photocopy of an operator license; however, nothing in this section shall be construed to prohibit the photocopying for other purposes of any amateur radio operator license.

§ 97.85 Availability of station license.

The original license of each amateur station or a photocopy thereof shall be posted in a conspicuous place in the room occupied by the licensed operator while the station is being operated at a fixed location or shall be kept in his personal possession. When the station is operated at other than a fixed location, the original station license or a photocopy thereof shall be kept in the personal possession of the station licensee (or a licensed representative) who shall be present at the station while it is being operated as a

portable or mobile station. The original station license shall be available for inspection by any authorized Government official at all times while the station is being operated and at other times upon request made by an authorized representative of the Commission, except when such license has been filed with application for modification or renewal thereof, or has been mutilated, lost, or destroyed, and request has been made for a duplicate license in accordance with § 97.57.

§ 97.87 Station identification.

(a) An amateur station shall be identified by the transmission of its call sign at the beginning and end of each single transmission or exchange of transmissions and at intervals not to exceed 10 minutes during any single transmission or exchange of transmissions of more than 10 minutes duration. Additionally, at the end of an exchange of telegraphy (other than teleprinter) or telephony transmissions between amateur stations, the call sign (or the generally accepted network identifier) shall be given for the station, or for at least one of the group of stations, with which communication was established.

(b) When an amateur station is operated as a portable or mobile station, the operator shall give the following additional identification at the end of each single transmission or exchange of transmissions:

(1) When identifying by telegraphy, immediately after the call sign, transmit the fraction-bar $\overline{\mathrm{DN}}$ followed by the number of the call sign area in which the station is being operated.

(2) When identifying by telephony, immediately after the call sign, transmit the word "portable" or "mobile", as appropriate, followed by the number of the call sign area in which the station is being operated.

(c) When an amateur station is operated outside of the 10 call sign areas prescribed in § 97.51(b) and outside of the jurisdiction of a foreign government, the operator shall give the following additional identification at the end of each single transmission or exchange of transmissions:

(1) When identifying by telegraphy, immediately after the call sign, transmit the fraction-bar $\overline{\mathrm{DN}}$ followed by the designator R 1, R 2, or R 3, to show the region (as defined by the International Radio Regulations, Geneva, 1959) in which the station is being operated.

(2) When identifying by telephone, immediately after the call sign, transmit the word "mobile" followed by the designator Region 1, Region 2, or Region 3, to show the region (as defined by the International Radio Regulations, Geneva, 1959) in which the station is being operated.

(d) Under conditions when the control operator is other than the station licensee, the station identification shall be the assigned call sign for that station. However, when a station is operated within the privileges of the operator's class of license but which exceeds those of the station licensee, station identification shall be made by following the station call sign with the operator's primary station call sign (i.e. WN4XYZ/W4XX).

(e) A repeater station shall be identified by radiotelephony or by radio telegraphy when in service at intervals not to exceed 5 minutes at a level of modulation sufficient to be intelligible through the repeated transmission.

(f) A control station must be identified by its assigned station call sign unless its emissions contain the call sign identification of the remotely controlled station.

(g) An auxiliary link station must be identified by its assigned station call sign unless its emissions contain the call sign of its associated station.

(h) The identification required by paragraphs (a), (b), (c), (d), (e), (f), and (g) of this section shall be given on each frequency being utilized for transmission and shall be transmitted either by telegraphy using the International Morse code, or by telephony, using the English language. If by an automatic device only used for identification by telegraphy, the code speed shall not exceed 20 words per minute. The use of a national or internationally recognized standard phonetic alphabet as an aid for correct telephone identification is encouraged.

[§97.87(*d*) *amended and rcdes. as* (*h*) *and new* (*d*), (*e*), (*f*), *and* (*g*) *added eff. 10-17-72; VI(72)-1*]

§ 97.89 Points of communications.

(a) Amateur stations may communicate with:

(1) Other amateur stations, excepting those prohibited by Appendix 2.

(2) Stations in other services licensed by the Commission and with U.S. Government stations for civil defense purposes in accordance with Subpart F of this part, in emergencies and, on a temporary basis, for test purposes.

(3) Any station which is authorized by the Commission to communicate with amateur stations.

(b) Amateur stations may be used for transmitting signals, or communications, or energy, to receiving apparatus for the measurement of emissions, temporary observation of transmission phenomena, radio control of remote objects, and similar experimental purposes and for the purposes set forth in § 97.91.

(c) Notwithstanding the provisions of paragraph (a), no more than two repeater stations may operate in tandem, i.e., one repeating the transmissions of the other, excepting emergency operations provided for in § 97.107 or brief periods to conduct emergency preparedness tests.

(d) Control stations and auxiliary link stations may not be used to communicate with any other station than those shown in the system network diagram.

[§ *97.89 amended eff. 10-17-72; VI(72)-1*]

§ 97.91 One-way communications.

In addition to the experimental one-way transmission permitted by § 97.89, the following kinds of one-way communications, addressed to amateur stations, are authorized and will not be construed as broadcasting: (a) Emergency communications, including bona-fide emergency drill practice transmissions; (b) Information bulletins consisting solely of subject matter having direct interest to the amateur radio service as such; (c) Round-table discussions or net-type operations where more than two amateur stations are in communication, each station taking a turn at transmitting to other station(s) of the group; and (d) Code practice transmissions intended for persons learning or improving proficiency in the International Morse Code.

§ 97.93 Modulation of carrier.

Except for brief tests or adjustments, an amateur radiotelephone station shall not emit a carrier wave on frequencies below 51 megahertz unless modulated for the purpose of communication. Single audiofrequency tones may be transmitted for test purposes of short duration for the development and perfection of amateur radio telephone equipment.

(Continued next month.)

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JAPAN	14A	14	7A	7B	7	7	7	7	7	7	14	14
MEXICO	14	7A	7	7	7	7	7	7A	14	14	14A	14A
PHILIPPINES	14A	14	7A	7B	7B	7B	7	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14A	14A
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	14	14A	14	14
U. S. S. R.	7B	3A	3A	7	3A	3A	3B	7B	7A	7A	7B	7B
EAST COAST	14	7	7	7	7	7	7	14	14	14	14A	14A

A = Next nigher frequency may be useful also.
B = Difficult circuit this period.

a JUST
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November 1973
26009

73 magazine
for radio amateurs

- K1CLL Hot on the Trail of 450 MHz
- Simple Amateur TV • more Autopatch
- Peak/Notch Audio Filter • more Slow Scan Contest • SSTV/SSB Independent Sideband • and, the Continuing Saga of the Wandering Rules and Regulations

73 magazine
for radio amateurs

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73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A. *Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.*

Amateur Radio

NOVEMBER MCMLXXIII Monthly Ham

Noting the apparent impossibility of obtaining changes in the repeater rules via normal channels, members of SERCOM (WA3KXF) and the Central Pennsylvania Repeater Association (WA3KZG) arranged a meeting with Congressman Edwin D. Eshleman of the 16th Congressional District of Pennsylvania to explain the situation and appeal for help. Congressman Eshleman was quite receptive and immediately invited correspondence with Chairman Dean Burch of the FCC. Congressman Eshleman did point out that a single Congressman cannot have much affect and as this is a national problem, all interest groups should contact their own Congressional Representatives. The multitude of repeater organizations should easily be able to get Congress working on our behalf.

(photo by WA3MHP)

Saudi Arabia on Slow Scan

Reprinted from the West Coast DX Bulletin.

A couple of stations have been showing up regularly and with 7Z3AB about to be missed, some hope may still exist. HZ1AB has been showing up around 14250 kHz from 1900Z. Says handle is Terry, using Collins gear to a rhombic antenna. . .advised that he will be on most weekends from 1900Z onward and working by districts. HZ1SH has also been showing up regularly in the last month. Gives his name as Fasil and says to QSL to Box 2108, Jeddah, Saudi Arabia. Sometimes in the lower reaches of twenty phone from 1000Z, and sometimes a bit surprising as to what you may hear. Like the following. . .this on SSTV.

W-station: "Please repeat your name and I will send my picture."

HZ1SH: "My name is Fasil. I am the King of Saudi Arabia. Please send your picture."

W-station: "I did not get your name. Did you say you were a king?"

HZ1SH: "Yes. I am the King of Saudi Arabia and my name is Fasil. Please send me your picture."

W-station: "But, I am in my pajamas. I am in my pajamas. Is that okay, King?"

HZ1SH: "Yes. Please go ahead."

W-station: "Okay. . .here it comes. . . . . ."

The point may be obvious but should it not be, if you are on SSTV be prepared!!! You may never know whom you are going to encounter. At least have a presentable photo available for emergencies.

FCC PROBLEMS

An FCC release re the repeater extension mentioned that one of the reasons for the extension was excessive problems with defective amateur repeater station applications.

May I state that from my experience this is directly due to the FCC, not to stupidity on the part of the repeater groups – who are not stupid.

From the outset, 73 Magazine has tried to keep abreast of the rapidly changing Walkerequirements for repeater applications, only to be met with resistance and incommunicativeness. It has been estimated that well over $35,000 has been spent on phone calls to the FCC just on the repeater application situation – and the result has been contradictions and evasions in many cases.

There has been no way to get the information on how to apply for a repeater license and publish it because the ground rules have been ever changing.

Take for instance the situation where Lou McCoy of the ARRL went to Washington, sat down with Walker and got the info on how to work out the height above average terrain (HAAT) calculations – something that appears so simple that even an idiot should be able to manage it, right? This, for some odd reason, was published under a nom-de-plume in QST and plaques and other awards were promptly given this mythical author. Hardly had the ceremonies concluded from all the award giving when Walker decided that this system of calculating HAAT was no longer acceptable.

Surely this is an exaggeration?

Of course the obvious answer is to get rid of the rules which are causing both amateurs and the FCC all the trouble. If the restrictions on antennas, power, crossbanding, tandem repeaters, control and such were removed, then a simple FCC form would suffice and there would be few problems.

News Pages

News of the World **73 MAGAZINE**

GEAR NEEDED

Anything and everything in ham gear is desperately needed by the radio clubs in Jordan. There are presently ten ham clubs there and each has an average of twenty active operators. King Hussein has given each club a rig for starters, but that doesn't scratch the surface. These hams want to operate and to build – and they need gear.

How about taking a good look in your closets, cellar, garage, attics, for workable transmitters, receivers, transceivers, exciters, test equipment, rotors, beams, and usable parts. Can you think of any better use to put these things to than helping new hams in a part of the world where radio parts and equipment just are not available?

By a special arrangement with His Majesty all equipment will be shipped at no charge from the Jordanian Embassy in Washington to Jordan – and there will be no import duty. The address is: Royal Jordanian Radio Amateur Society, c/o Royal Palace, Amman Jordan, via Embassy of Jordan, 2319 Wyoming Avenue NW, Washington DC.

Sideband and CW rigs will be particularly useful – and even VHF rigs will be helpful now that there is a repeater set up in Amman. If there is something wrong with the rig, make a note of it on a tag so they will have a good chance to fix it up over there. But remember that parts are incredibly difficult to get. They take months to arrive when ordered and there are NO radio stores as yet. Please drop a note to 73 and let us know what you've sent. Here is your chance to help out.

CLIPPINGS NEEDED

Please, when you see an article in the paper about amateur radio – clip it out and send it to 73 – or at least a copy of it! We use this material for our news pages – and for letters to congress. We need the material to work with if we are going to do a job for you.

Here is a Who's Who of the Arab Radio Net – just the chaps you'll want to contact to get that coveted Arabian Knights award. Left to right are 7Z3AB, ST2SA, 9K2AL, SU1MA, JY5GQ, JY5AT, JY1, JY4IA, 9K2AM, OD5FJ, JY5KA, JY5AA, OD5FI, JY5AH.

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	
Technician Class	50.100 – 54.000, 145.000–148.000, 220 MHz band and above.	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

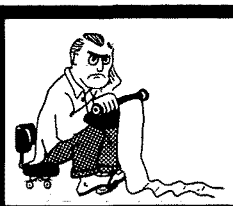
Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

RECIPROCAL LICENSING Between U.S. and: CE - CP - CT1 - CX - D - EI - F - G - HB9 - HC - HI - HK - HP - HR - LA - LX - OA - OH - PA - PY - SM - TG - TI - VE - VR2 - VU - YB - YN - YS - YV - ZL - ZP - 3A - 4X - 6Y - 8P - 9K - 9L - 9Y.

THIRD PARTY AGREEMENTS Between U.S. and: CE - CM - CO - CP - CX - EL - HC - HH - HI - HK - HR - JY - LU - OA - PY - TG - TI - VE - VO - XE - XP - YN - YS - YV - ZP - 4X - 4Z - 8R - 9Y. Also W/K/8P.

RESTRICTED COUNTRIES (don't work) are now down to only Vietnam(s) 3W8 and XV, with the exception of XV5AC being okay.



NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

REPORTING OPPORTUNITY

The fine job that the two reporters from the Washington Post did in following up the Watergate questions is proof of what can be done when odd things like this are investigated carefully. Another such opportunity seems to have appeared for this type of investigative reporting, though it would not be of the magnitude of the Watergate revelations.

The patently ridiculous docket 19759 calls out for such an investigation. How could such a docket ever come to be presented for serious consideration? If it made it through the normal decision making procedures of the FCC, then there is something radically wrong with the way this works and changes need to be made before more such idiocies emerge. If there was skullduggery, then the dirty work needs to be exposed and the people involved flushed out.

A person with persistance could follow up all of the trails of the docket, starting with the Electronic Industries Association and the companies which have been paying the piper for this "license to make money."

If the FCC does have clean hands in this, then they should cooperate with an effort to prove it. If some of the FCC officials have hidden motives, then a cover-up can be expected, with secrecy and buck-passing. Frankly, I suspect that there is the material here for a good solid congressional investigation.

73 A LITTLE THINNER

There are two "non-profit" ham magazines, one by charter (QST) and the other because I run it that way. The major difference between the two, from the financial end, is that I put every dollar that is available into making 73 bigger and better – and QST puts it into the bank. The result is that they have, at their last report, $1,072,000 in bank deposits and securities, and 73 has about one thousandth of that.

Normally this doesn't make any difference and 73 puts out as much magazine every month as the income will permit. The bind comes when something extraordinary comes along – like an IRS suit. This can get expensive and this is why most people faced with such a thing have to just give up and pay, no matter how outrageous the decisions. You do read every now and then about someone who has had the guts (and the money) to fight this bunch – it usually takes the shape of a small newspaper story on a chap who has fought them through the IRS courts for several years and who was finally found innocent.

The methods used by the IRS agents are the closest thing I've seen to the good old German Gestapo. They threaten and intimidate witnesses – they seem to be able to spend any amount of money for the most trivial items.

I'm just beginning to learn about this outfit, and what I've seen so far is blood curdling. They seem to prey on small businesses, the ones that don't have enough money to fight back and who just have to be closed down. If the expenses we've had are any indication, perhaps you can see why most firms just have to fold up. Our legal expenses so far have been over $20,000 – and that is just the beginning, with another $20,000 at least for the trial. I'll leave it up to you what a sudden expense like this would do to you or your business.

The one-sidedness of the IRS is so manifestly unfair that you might wonder why you haven't seen articles about it in newspapers and magazines. From what people who have been involved tell me, the IRS is extremely vindictive and the slightest adverse article often brings on a full audit and investigation—and you've read enough to know that they *always* find that you owe them money. The fact is that publishers are scared silly of the IRS and throw out almost everything that might stir up this hornet's nest of people who have almost unlimited power—and know it.

What does get into the papers are the releases that the IRS public relations departments send out. These are totally biased in favor of the IRS and are usually the rankest propaganda—and the victim has no recourse. Not only won't the paper publish his side of the story, if he can get it to them, he is faced with the reactions of his former friends and neighbors who have read one side and one side only—and harbor the strong suspicion that if the papers printed it, it must be true.

Well, at any rate, since 73 does not have any $1,072,000 put away in reserves, the expenses of the IRS suit have to be covered by printing a little thinner magazine for a few months. We hope that you understand.

You probably want to know what the case is against 73. So far as we can tell the great crime that has been committed – and this is a criminal prosecution with the attempt to put me in jail – is that the IRS, without asking me about these things, has decided that some items taken by our bookkeeper as business expenses in the years 1966-67-68 were actually personal expenses of mine and therefore the IRS has been defrauded. Just what all these things are will be brought out at the trial, but from what I've seen, they've decided to disallow trips to hamfests and conventions where I spoke, showed slides, and sold subscriptions.

My trips to foreign countries have been valuable – I've worked from many rare spots and this makes for 73 to be better known – and gives me better perspective to write and edit 73 —and the articles that I have written in 73 about my trips have been well received. The recent article on Jordan is a good example – without wide DXing experience I never would have made it to Jordan in 1970—and thus I would never have had the opportunity to meet King Hussein and convince him that amateur radio would be of great benefit to his country with the resulting explosion of amateurs. We don't know where this will stop, but it should be obvious that the few dollars spent in my going to Jordan were well invested – the whole trip cost about $1000.

But what happens to a $1000 expense that is disallowed? Well, that means that there is an extra $1000 in personal income that was not reported – and this means perhaps $400 in taxes (how much tax do *you* have to pay on an additional earned dollar?). Add a 50% fine to that for not reporting it and you have $600 – then add interest to it for seven years at 6% and it magically escalates to $902! But you're not through yet. Since that was disallowed as a business expense, that means that the business had $1000 in unreported income – but the tax on that is probably only about 33% – or $333. . .and then you add in the 50% fine to bring it to $500. . . and then the interest for seven years brings it to $752. Add the two together and you have a tax of $1654 on a single disallowed $1000 expense. Now you can see how the IRS comes

(Cont. on page 102.)

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

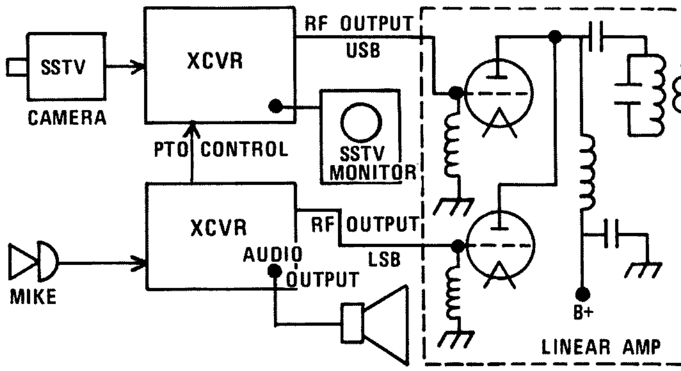


Fig. 2. ISB with two transceivers.

The 73 Slow Scan video program contest we first announced last month is off the ground, and happening right now until December 31, 1973, so get 'cracking on an outstanding program tape, (and I hear some of the gang really have some good ones planned) and win yourself a Robot Model 61 fast scan viewfinder. This contest is for the most interesting SSTV Program, with technical aspects also counting in the scoring. The "program" time limit is 6 minutes, and entry cassettes with sufficient return postage enclosed, should be sent to 73 Magazine. From here, they will go to "another" judge. The main objective of this contest is to get more fellows thinking and acting in terms of good programs, not just IDs and CQs. We're not stopping with just this contest, either. In February, we're joining with CQ Electronica of Italy in the 1974 Worldwide Slow Scan contest, and will present certificates to many U.S. and world leaders. More on this closer to that contest time.

Slow Scan continues to grow in popularity while also boasting some of the more exotic ideas in ham communication today. One example is a "SSTV Graphic Slate," which is presently being developed by WØLMD. This device would allow one to sketch out a Slow Scan picture, ID, schematic, etc., on the unit's built in cathode ray tube with a special "pen." This pen looks like a little pencil flashlight, but acts as a light sensor, rather than a light source. So, rather than actually marking on the crt face with ink, the "pen" makes lines which appear as black on the white raster of the crt. The drawn picture stays on the crt (and can be transmitted on Slow Scan) until the "memory erase" button is pushed, clearing the crt face, thus preparing for the next picture. Visualize the operation like this: An "overlay" of a schematic is placed on the crt, and traced out with the pen. The overlay is removed, and there, on the screen is the schematic. A block diagram of the unit appears in Fig. 1. Briefly, the unit works like this: A cathode ray tube produces a raster and a "light pen" generates a signal when light detection occurs at a spot pointed at. A 15,360 bit shift register memory traces the raster, and when the light detection occurs a blanking bit is set into the appropriate memory position. The detected light spot is then blanked on subsequent raster scans by a Z axis amplifier driven by the memory output. The drawn circuit, or message, is thus recorded on the refreshed crt "memory" screen. This drawing process continues until the desired picture is completed, then the memory clock slows down from 614 kHz to 1920 Hz to output memory at the SSTV rate. The crt is an old 9" TV crt, and the light pen uses a phototransistor and focusing lens assembly. The unit's memory costs approximately $60, and a complete unit would probably be around $100. Incidentally, Robert also now has available schematics, scope patterns and descriptions of both the WØLMD SSTV keyboard and the WØLMD scan converter (approximately 13 pages worth!). Cost to reproduce and mail each set is $1.25.

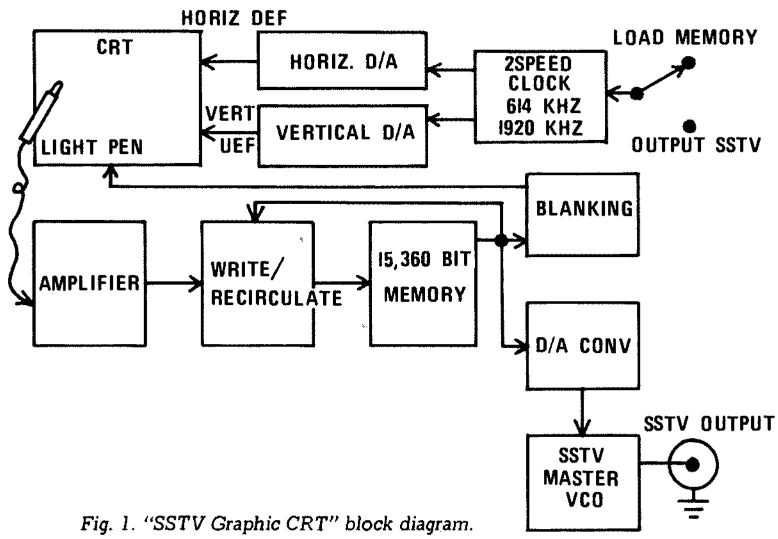
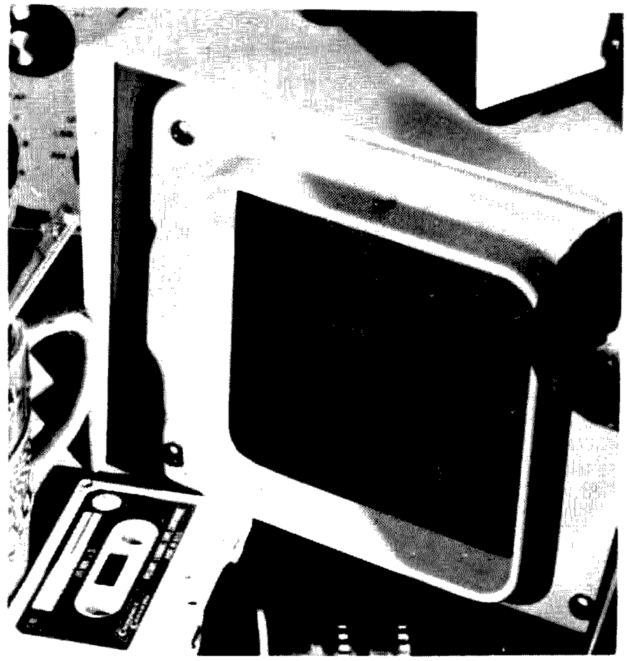


Fig. 1. "SSTV Graphic CRT" block diagram.

Another company, Venus Scientific Inc., of Farmingdale, New York, recently entered the Slow Scan field and should have their monitor available by the time you read this. Venus, as you may know, has built cathode ray tube high voltage modules for some time, so it was only natural for them to use some of them in such a related field as Slow Scan. Their monitor, designated the SS-2, is quite compact compared to other units and displays a picture of approximately 8.3 cm square. The unit is all solid state, completely self-contained, uses electrostatic deflection, and has a double purpose front panel control for either manual vertical retrace or frequency spectrum analysis (called accu-sync and similar to the system described in my June SSTV Scene column) of the incoming SSTV signal. The front panel crt bezel is constructed to accept an optional viewing hood or polaroid camera adaptor, and a front mounted "flip down foot" is provided for convenient viewing. The circuitry is primarily constructed on 3 plug in pc cards, which include LED sweep indicators for fast servicing in the field. Well, it sounds like manufacturers are getting hot on what Slow Scanners want, and are trying to deliver. I understand they are even working on a direct fast to Slow Scan converter. Finel I have heard (through the "grapevine") the SS-2 crt is a special square face unit and suspect a special focus system may be used also. Since the "electron activity" is confined to a relatively small screen, brightness may be fairly high. Although I have not seen their unit as of this writing, I hope to shortly, so I can give you the full evaluation story.

An interestingly different approach to ISB (transmitting audio on one

73 1st Annual magazine's



RULES:

- 6 minute maximum time length
- Subject matter is limited only to your imagination — anything goes.
- Label cassette with your return address and include sufficient return postage. All programs will be returned.
- Decisions of the judges will be final.
- Contest starts now — entries must be mailed before December 31, 1973.

First Prize

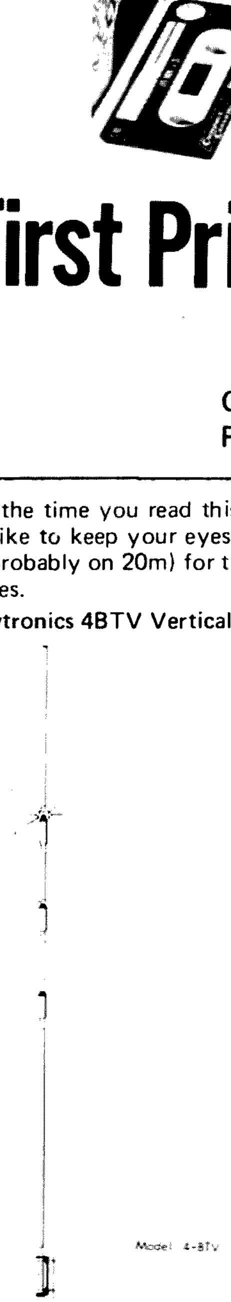
ROBOT Model 61
Fast Scan Viewfinder
Other prizes to be announced.

Send your entry to: Slow Scan Contest, 73 Magazine, Peterborough, NH 03458.

}eband, and SSTV on the other }eband simultaneously) which is prently being investigated by Bill 4CVS, is shown in Fig. 2. Here, a ıir of identical transceivers (like SB)1s) are shown feeding a common ıear amplifier, (one using a pair of 400s, for example) whose plates are parallel, but control grids are fed dependently from each transceiver. ıe "SSTV transceiver" is on upper }eband and the "audio transceiver" on lower sideband. Each tube in the ıear amplifies its respective signal, ıd feeds it to the output tank circuit, us resulting in an ISB output signal. relay switching system connects ch rig to a separate antenna on ceive. Note, the two transceivers use common ptc, thus tracking together ut on opposite sidebands) to elimiıte frequency "zeroing" problems. I :lieve Bob WA7MOV, tried a system ımewhat similar to this a while back, which the two transceivers fed one ıear amplifier through a phasing line stem, described in the Editors and ıgineers Handbook as a "magic tee" :twork. I suspect others will be ying ISB before long by just using ıe old mobile rig on an extra antenna ır audio, and the "big rig" on Slow :an.

I have word that XW8CO, FM7WW d a certain KG6 should be on Slow Scan about the time you read this, so you might like to keep your eyes and ears open (probably on 20m) for these new countries.

The Newtronics 4BTV Vertical



Recently I found myself in need of a good omnidirectional antenna for the 40 through 10 meter bands. Often the band would be open in three directions simultaneously, and I was missing too much DX which seemed to be always off the sides and back of my 3 element beam. Further, I was spending more time turning my beam than I was operating during large Slow Scan TV round tables. (There's enough fumbling in the shack already!)

At this point, I laid a dozen or so radials and erected my old (commercially built) trap vertical. My desires of coverage were met, and the results were gratifying. The bandwidth and SWR were not. In fact, the antenna was only usable on the upper portion of 20 meters, due to high SWR.

After careful study of the available antennas, a decision was made and a Newtronics 4BTV vertical was purchased. I put the antenna in my car (it's packaged in a nice, small box) and headed home.

The antenna and transmission line connectors went together smoothly within an hour, thanks to the fine instruction manual and tuning charts. If you go strictly by the chart, the antenna will work right off with low SWR on all bands. Naturally dimensions are given for either ground or roof mounting.

Then I went outside to mount the antenna and run more (approximately 15) radials. Here I found a dandy idea

Newtronics doesn't emphasize nearly enough. The antenna proper slips over and clamps to its base. Thus you can mount the base, run transmission line, radials, etc. Then just slip the antenna over it. This feature is extremely handy when tuning the antenna for your favorite frequency, as I will describe later.

The antenna worked perfectly from the start, with an SWR never over 1.3:1 on any part of any band. I was pleasantly amazed! QSOs with Europe and Australia the first day confirmed the antenna was working. Indeed, I often swapped between the beam and vertical during contacts, and the results were equal signal reports.

I measured the impedance with an Omega T noise bridge and again was surprised – 48 to 52 ohms on all bands! (I'll never tell what my beam was.)

Newtronics was encouraging on fine-tuning the antenna, so I tried adjustment. Originally the resonant frequency (1:1 SWR and 51 ohms impedance) was 14.130 kHz. I retracted the 20 meter adjustment slightly, and moved the exact resonant frequency to 14.230 kHz, my favorite spot. Checking the extreme band edges now showed a 1.3:1 SWR. Thirty minutes later, I had the antenna tailored exactly to my needs on all bands.

The real proof of this antenna came during the first of 1973, as I tried for the 73 73 73 award (work 73 countries during the first 73 days of 1973). I accomplished it with over two weeks to spare, and used the 40–10 meter bands. Often the TR-4 was used barefoot. However, all contacts were made using only the 4BTV (and some of those were quite exotic DX).

Now the proof period is over and I'm still enjoying the antenna. Last night, for example, I exchanged good quality Slow Scan TV pictures with TU2DO on Africa's Ivory Coast.

I've heard a few people say verticals didn't work for them, or radiated poorly. Closer investigation with these people revealed they had not followed proper construction techniques (home brew) or instruction sheets (commercially built). Often the vertical(?) was mounted 15 or 20 feet above ground on a metal pipe, strapped to a chain link fence. Some used radials, some didn't. This is no good. *Follow the directions.* Either mount the antenna at ground level, with radials (preferably two for each band) or on the roof, *insulated* from ground with 45 degree drooped radials to form a ground plane. Then results will be optimum and I think you will agree the Newtronics 4BTV is tops.

K4TWJ

50 MHz BAND

Bill Turner WA0ABI
Five Chestnut Court
St. Peters MO 63376

The September contest came and went without much of a stir. . .the high point in the eastern half of the country was an excellent quality Aurora for a few hours Sunday afternoon. W8CCI, VE2DFO, WB2LZD/3 and several others were very active on scatter. Cross your fingers, perhaps December will be better.

How many suffered coronary problems when Rayburn KH6HPV, called CO and recovered when they heard the portable 5 tacked on the end? Vern W0CYF, has returned to six after many years absence. Kevin W1GAO, mobiled from Boston to St. Louis and back making two meter contacts all the way. What, no six meter gear in the car?

Dick WA5CHK/DA1RG, writes from Germany that his tour of duty will be over after the first of the year and by early spring expects to be back in Houston with his TR-6, Mark 6B and four 9 element beams at 70'. Dick says he is active on the DC bands and 2 meters but nothing takes the place of six. He is looking forward to working scatter with K8LEE, K8MM, et al.

Bob WA2AAR writes to tell of a new narrow shift RTTY net becoming active on 50.130 in the New York-New Jersey area. The net, which doesn't have a name as yet, will meet Sundays at 11 AM eastern time. Anyone desiring more information may contact Bob at 164 Steuben Street, Jersey City NJ 07302.

From Art WA1EXN: "At about 1508 Z, July 30, W1ELP called me and stated he was hearing a CW signal at 50.158 and wanted me to monitor and see if I could also hear it. Here is what I got at S4 with QSB from 1510 Z to 1550 Z. Beam heading 160 degrees. GYS DE SWIE SP 768 K (with sometimes a K in place of the Y). We tried reciprocal headings, Bill could hear the signal, I could not. . .Does one of your readers have an answer as to just what we might be hearing?" In a later on-the-air conversation Art mentioned that the above had been heard again. Does anyone have the answer?

For several months I have been trying to find space for a lengthy and most interesting letter from Geoff Wilson VK3AMK. To get it in it has been necessary to edit rather severely and to bend Wayne's space limitations. Consider this my apology to both.

"The frequency allocation for all VK call areas is 52-54 MHz. Up until 1964 we had 50-54 MHz but lost the lower 2 MHz to TV. The band is now sandwiched between our Ch. 0 (45-52) and Ch. 1 (56-63). The allocation of Ch. 0 was a very bad mistake as the QRM on this frequency is particularly bad during the summer sporatic E season when the three main high power Australian TV stations not only QRM each other but also cause QRM to TV reception in New Zealand on their CH. 1 (44-51). Operators in Melbourne and Brisbane suffer very much the same QRM troubles as U.S. stations operating near your Ch. 2. Despite this many stations are active in these areas. In fairly recent times there has been increased FM activity, mainly on 52.525 MHz and many stations use this frequency exclusively. The great majority of operators use AM or SSB, using the section 52.0-52.5. SSB is becoming increasingly popular with at present about 65% of the stations using this mode. AM on six is fast giving way to SSB except in the case of the younger operators just starting out, but even here some are going SSB. Until very recently there was no commercial gear available in VK apart from exservices or commercial equipment (surplus, ed.). At present about 50-60% of the SSB gear is commercial and with few exceptions consists of Yaesu FT-101s, FT-200s, etc., driving FTV-650 transverters. The power limits in VK are 150 W dc input or 400 W PEP output. But, very few stations are running this sort of power, mainly due to the extremely high cost of tubes.

The only recognized calling frequency is 52.050 MHz for SSB. This has been in use about two years and has worked out very well. There is virtually no CW on the band here except for meteor scatter operators. Many of the people on six are operating under similar licenses to your Technician class and *cannot* use CW.

The DX period is mainly late October to February which is our summer Es season. However, we are finding more and more that openings occur at any time and to help give a better picture of what is happening a number of beacons have been set up between 52-53 MHz, including several in VK0.

Normal contacts vary with location, equipment, etc. But, I can work most stations within 180 miles or so at any time with a pair of 6146Bs and a 6 element Yagi at 52'. I have kept daily skeds over a very mountainous path of 140 miles and never been unable to copy my report. Usual signals are about 5X6 each way with QSB to S9 plus at times.

Our normal Es season DX would average about 1000 miles single hop. From this area (Melbourne metropolitan) we mostly work stations on the Northcentral coast of VK4, about 300 miles north of Brisbane. I regularly work stations in this area during the summer months running 300 mW of SSB. We consider it a very bad season here if we don't

work VK1-8 at some time during the summer. There has not yet been a two-way QSO with the Antarctic continent. But another Melbourne station (VK3BFG) and I were copied by VKØPF during late 1971 but were unable to hear VKØPF's signals despite 20 meter liason. We usually work ZL stations each year but lack of activity there is discouraging. Stations in northern Australia regularly work JAs between 52 and 52.5. Very rarely do we get JAs further south, although they have been worked in VK7 fairly recently. The signals from JA come via F2 into northern VK and are carried from there to VK3 etc., via sporatic E extension. In other words, if the JAs are coming into VK4 and we also have sporatic E to that area we may hear and work JAs. In 10 years of concentrated activity there have been three really workable openings.

Back in 1958-59 VKs worked into XE, but since losing the lower 2 MHz of the band DX is much harder, not only because many stations do not operate in our section, but also because the MUF doesn't always rise that extra 2 MHz. (I often get ZL TV video on 46 MHz, but no sound on 50 MHz until the MUF really peaks up.) Northern VKs have worked HL, KX6, KH6, etc., apart from JAs recently."

With the recent increase in interest in reactivationg TV Ch. 1 for educational purposes U.S. amateurs would do well to heed the warning in Geoff's letter and in the recent FCC 220 proposal.

. . . WAØABI

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

Oct. 27-28	CQ WWDX Contest, Phone
Nov. 2-5	CHC/FHC/HTH QSO Party
Nov. 5-11	QRPP CW QSO Party
Nov. 10-11	EX-G Contest
Nov. 24-25	CQ WWDX Contest, CW
Dec. 1-3	Delaware QSO Party
Dec. 15-16	EA (Spanish) Contest, CW

OCTOBER

CQ World Wide DX Contest, Phone

From 0000 GMT Oct. 27, to 2400 GMT Oct. 28, 1973. All bands 160 through 10. Three divisions: (a) single operator, single or all band (b) multi-operator, single transmitter (c) multi-operator, multi-transmitter. Only one signal per band permitted. Exchange RS/T plus your CQ zone. QSO point values: 3 points between stations on different continents, 1 point between stations on the same continent but in different countries; contacts between stations in the same country are permitted for Zone and/or Country multiplier but have no QSO point value. Multiplier is sum of zones and countries worked on each band. CQ Zone and ARRL & DARC country lists are to be used. Final score: (a) single band – zones plus countries multiplied by QSO points (b) all band – sum of zones plus sum of countries from each band multiplied by total QSO points. Use a separate log sheet for each band, 40 contacts to the page. Indicate zone and country *only first time* it is worked on each band. See the appropriate issue of CQ for official rules and list of 25 trophies. Official log and summary sheets are available from CQ. Include a large SASE or IRCs. Address is: CQ World Wide DX Contest, 14 Vanderventer Ave., Port Washington, L.I., NY USA 11050.

SSTV PROGRAM CONTEST

The 73 Magazine SSTV Program Contest will no doubt be a big hit with Slow Scanners. There is plenty of time to get your program together since programs may be entered anytime between now until Dec. 31st. See page 7 for complete details.

NOVEMBER
CHC/FHC/HTH/QSO PARTY

From 2300 GMT Nov. 2, to 0600 GMT Nov. 5, 1973. More complete details available from IARS at the address below. Suggested frequencies are 3575, 3710, 7070, 7160, 14075, 21075, 21090, 21140, 28090, 3770, 3775, 3790, 3943, 3960, 7090, 7210, 7260, 7275, 14320, 14340, 21360, 21440, 28620, 28690, 50.1-50.5, 145-147. Exchange QSO number, RS/T, name, state and county (for U.S.), and give CHC number or FHC number. All who do not hold an IARS assigned CHC number are HTHers and send "HTH" as part of their exchange instead of CHC/FHC nr. Scoring system: CHCers score 1 point per QSO with other CHCers, 2 points if with an HTHer, count 1 additional point if contact – YL, blind/paralyzed, FHC, novice, VHF/UHF, CHC-200, merit, club station. Add above points. If contact was out of own country, double points for that contact. HTHers score 1 point per QSO with an HTHer, 3 points if with a CHCer, otherwise same as above. Same station can be worked on each band/mode. Each different continent, country, ITU zone and U.S. state is a multiplier. Each different band or mode used is a multiplier. Multiply total QSO points by total multipliers. Multi-op stations divide total score by number of ops used. Appropriate awards. (CHC means Certificate Hunter's Club, FHC – Flying Ham's Club, HTH – Hunt the Hunters). Mail logs and contestant form (available from IARS) within 15 days after end of party to: IARS, Inc., Clif Evans K6BX, P.O. Box 365, Bonita CA 92002.

QRPP CW QSO PARTY

From 1300 GMT Nov. 5, to 2300 GMT Nov. 11, 1973. Exchange RS/T, state (or province or country), and QRP number. Non-members of QRP-ARCI send "NM" and power in watts instead of QRP number. Frequencies are, 3540, 7040, 14065, 21040, and 28040 (plus or minus 5 kHz of course). Stations may be worked once per band for multiplier points. Member contacts count 2 points, NM contacts count 1 point. Power multipliers are – under ½ watt output, X15, – under 2 watts, X10, – under 5 watts, X5, – over 5 watts output – no multipliers. Multiply total QSO points by total state/countries and multiply this by power multiplier for final score. Appropriate awards. Logs must be readable and include date, time, exchanges, stations worked, band and power used. Enclose a cover sheet showing your computation of equipment description and statement that all rules were observed. Logs must be postmarked by Dec. 3, 1973, and sent to Earl R. Lawler W5JLY, Rt. 2, Box 24-K, Burnet TX 78611.

EX - G CONTEST

From 0000 GMT Nov. 10, to 2359 GMT Nov. 11, 1973. Maximum operating time permitted is 24 hours. Minimum time off for short breaks is 15 minutes. The contest is in three sections: (1) reciprocal operators, (2) non-reciprocal operators, (3) United Kingdom operators. Any licensed frequency and mode. Suggested frequencies are, 3950, 7250, 14347, 21415, 28650. Only the first QSO between two stations shall count for QSO points. Contest exchange from reciprocal operators – RS/T, serial QSO number, club member yes/no, and original call. From non-reciprocal operators – RS/T, serial QSO number, club member yes/no. From UK stations – RS/T, serial QSO number, club member yes/no, original call (if reciprocal operator) and name of football (soccer) team they support. (All references to "club" above mean the EX-G club). Scoring: Reciprocal ops score 1 point per QSO with non-reciprocal operators, 2 points if with a reciprocal operator. Non-reciprocal

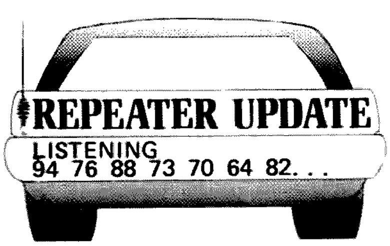
73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				EQUIPMENT
		Hz				
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS



AL	WA4UAG	Huntsville		145.992-147.120
AL	WR4ACB	Birmingham		146.16-146.76
AL	WR4ADD	Birmingham		146.34-146.94
AZ	WR7ABM	Tucson		146.28-146.88
AZ	WR7ABL	Payson		Planned
CA	WR6ACK	Santa Monica		147.93-147.33
CA	WR6ABX	Sacramento		146.37-146.97
CA	WR6ACG	Bishop		146.34-146.94
CA	WR6AAA	Catalina Is.		147.69-147.09
CA	WR5ABB	L.A.		146.01-146.61
CA	WR6AAD	L.A.		147.96-147.36
CA	WR6AAE	L.A.		146.22-146.82
IL	WR9AAF	Chicago		146.34-146.94
IL	WR9ABQ	Elgin		146.19-146.79
IN	WR9ABA	Indianapolis		146.10-146.70
IN	WR9ABI	Elkhart		146.04-146.64
IN	WR9ABO	Muncie		146.13-146.73
IN	WR9ABR	Columbus		146.19-146.79
KS	WRØABU	Kansas City		146.22-146.82
KS	WRØABV	Lenexa		52.88-52.525
KY	WR4ACO	Owensboro		146.34-146.94
KY	WR4ACR	Lexington		146.16-146.76
MA	DL2AA/WR1	Medway		147.81-147.21
MD	WRØABP	Barry		Closed
NC	WR4ABD	Aurora		146.34-146.94
NB	WRØABQ	Omaha		146.34-146.94
NY	WR2ABP	Bedford		147.705-147.105
NY	WR2ACD	Manhattan		146.40-147.00
OH	WR8ABT	Cheviot		146.07-146.67
OK	WR5ABW	Enid		146.34-146.94
SC	WR4ACD	Columbia		146.34-146.94
SD	WRØABX	Sioux Falls		146.16-146.76
TN	WR4ACS	Nashville		146.16-146.76
TN	WR4ADA	Chattanooga		146.19-146.79
TX	WR5ABN	Midland		146.16-146.76
WI	WR9ABE	Baraboo		146.26-146.86
WI	WR9ABI	Madison	T2100	146.16-146.76

operators score 0 points with non-reciprocal operators, 2 points per QSO if with a reciprocal operator. Multiply QSO score by number of EX-G club members worked. Bonus points – multiply number of British stations (G, GB, GC, GD, GI, GM and GW prefixes only) operating from the UK by the following factors depending on your location: EU – X1, NA/SA – X3, AF, north of Lat. 10°N – X2, AF, south of Lat. 10°N – X3, ASIA, west of Long. 90°E – X3, ASIA, east of Long. 90°E – X4, AUSTRALASIA – X5. Multiply total QSO points by club member multiplier and add bonus points for final score. Appropriate awards. Logs before Dec. 25, to: Contest Committee, EX-G Radio Club, J. Kasser G3ZCZ/W3, Chairman, 1701 East-West Highway, Apt. 205, Silver Spring MD 20910 USA. SASE for results.

CQ World Wide DX Contest, CW

From 0000 GMT Nov. 24, to 2400 GMT Nov. 25, 1973. All other rules same as phone section. Complete details elsewhere in this column.

To date I have no information on the ARRL Sweepstakes Contests other than the dates. Nov. 10-11 is the Phone SS; the CW section is Nov. 17-18. You'll have to check the appropriate issue of QST for further details.

All contests this month appear to be international in coverage, so if you are a DXer, you could do worse than to enter a few of them. The CQ DX Test would be your best bet, of course. The SS Tests are not international in coverage, yet they are about the best contests around for USA and Canadian contest buffs. I will definitely be operating in the WWDX tests and the SS tests and hopefully a few of the others this month.

WB8KZD

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

The frequency of the month is 144.480 MHz. It is widely used for simplex working in Europe and is also a repeater input frequency in Hong Kong. This month let's consider the two meter frequencies in use in Europe. Most countries in Europe have up to now "band planned" the occupancy of the 144-146 MHz (all

they have) on a geographical basis. Stations in one area concentrate their signals into a section of the band, stations in another area use a different section of the band. Thus, when tropospheric openings occur hams know where to tune for the DX. Separate country wide frequencies are allocated for beacons, SSB or CW. All this is done on a voluntary basis by the hams themselves through their national societies and is not written into their licenses.

HOLLAND

Holland has no repeaters at present, but they have allocated simplex channels on a regional basis as follows:

Amsterdam	144.480 MHz
The Hague	144.800 MHz
Utrecht	144.700 MHz
Rotterdam	145.600 MHz

ENGLAND

FM Calling Channel	144.480 MHz
Mobile Calling (AM and FM)	145.00 MHz
Working South of England	144.400 MHz
Working London Area	144.800 MHz
Working Midlands	145.200 MHz
Working North of England	145.600 MHz

Europe is channelising the 145.00 to 145.900 segment of the band for FM with channels spaced every 25 kHz. The agreed new IARU channels for England are:

FM Calling Channel	145.500 MHz
Working Southern	145.525 MHz
Working London	145.550 MHz
Working Midlands	145.575 MHz
Working Northern	145.600 MHz

The idea being to establish contact on the calling channel and then QSY to a working channel. It will be interesting to see what happens when repeaters come into general use in England. The calling channel will then be the repeater channel, I suppose.

G3ZGO writes from London as follows: He suggests that visitors have 145.000 MHz and a means of copying AM (I suggest that the visitor carry a police band monitor that tunes down to 144.000 MHz. I used one in conjunction with a TR-22 last time I visited Europe and it worked out fine.). For built up areas he suggests 144.480 MHz. For very built up areas have one of the working channels too. For London have 144.800 MHz, as it will be nearly impossible to QSO on 144.480 MHz during busy times. In England the TR-22 comes with the following three channels fitted as standard: 144.48, 144.72, 145.32 MHz. The two meter band is shared with aeronautical services in England and several spot frequencies must not be used by hams. One of them is 144.72 MHz. So the rigs are usually tuned up to 144.725 MHz. Lastly, 145.32 MHz is used by SSB stations and they QRM the FM boys.

According to OHM Magazine there is at least one repeater in Hong Kong. The frequency is listed as 144.48 In – 145.64 Out, and there are over 20 VS6's active on two meters.

If you are going mountain climbing in Switzerland you might consider taking your handi-talkie with you. This summer one W3/HB9 worked into Italy, Austria and Czechoslovakia using an HT220 fitted for 145.000 MHz from the top of the Matterhorn. Some hams really live it up.

. . .G3ZCZ/W3

FCC NEWS

FCC EXTENDS TIME LIMIT FOR REPEATERS . . . .

Adopted: August 29, 1973 – Released: August 30, 1973.

By Acting Chief, Safety and Special Radio Services Bureau.

1. The Commission has under consideration, on its own motion, the extension of the license term of all amateur stations licensed prior to October 17, 1972, and operating to automatically retransmit the radio signals of other amateur radio stations or as remotely controlled stations prior to that date. The purpose of our action herein is to preclude any unnecessary interruption of any on-going service due to delays in processing applications.

2. In Docket 18803 the Commission adopted rules pertaining to the licensing and operation of amateur repeater stations. Those rules became effective on October 17, 1972. All stations licensed after October 17 had to comply with those rules. However, to provide continuity of operation and to assure continued public service activities, existing repeater stations were granted a grace period to June 30, 1973, to bring their operations into full compliance with the rules and to obtain a new license. At the request of the American Radio Relay League this period was extended to August 30, 1973.

3. We find that more than adequate time has been given to those previously existing stations to allow their operations to be brought into compliance with the rules. However, because of the initially heavy administrative work load imposed upon the Commission, the fact that initially filed applications were generally inadequate, and because of the lack of processing personnel during the summer months, we find that there has been inadequate time for all existing licenses to actually receive their license documents evidencing their full compliance with the rules. Therefore, we will allow all amateur stations licensed prior to October 17, 1972, which were operating to automatically retransmit radio signals of other stations or as a remotely controlled station, and for which a timely and sufficient application for renewal or modification was filed to continue operation until final action is taken on the application. An application will be considered as being timely filed if it was received by the Commission on or before August 30, 1973. The application will be considered as one for renewal or modification if it proposes to license transmitting appartus which was previously operated as a repeater or remotely controlled station.

4. Accordingly, the Commission by the Chief, Safety and Special Radio Services Bureau, pursuant to the delegated authority in Section 0.331 (b) (1) of the Commission's Rules, ORDERS that all amateur stations licensed prior to October 17, 1972, which were automatically retransmitting radio signals from other amateur stations or licensed as remotely controlled stations and for which a timely and sufficient application has been filed, may continue to operate until such time as the Commission takes final action on the application.

FCC
Charles A. Higginbotham
Acting Chief, Safety
and Special Radio Services Bureau

. . . . BUT BLAMES *AMATEURS* FOR PROBLEMS!

There apparently has been some confusion among amateur licensees as to the actual effective date of the rules adopted in Docket 18803. The Commission reiterates what should be clear to all amateur licensees that the rules became effective October 17, 1972. Licensees have been informed in the Report and Order, the Memorandum Opinion and Order, and by several Public Notices and Orders, that full compliance was expected as soon as possible but not later than June 30,

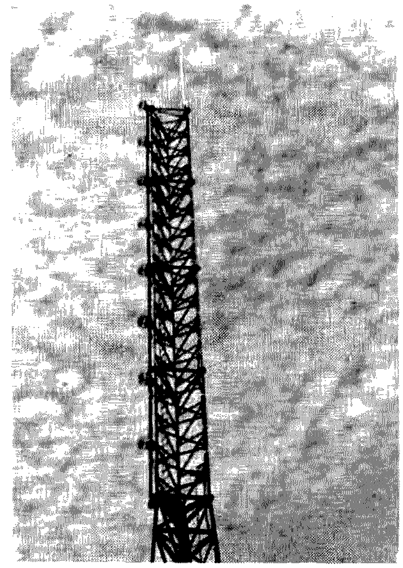
subsequently all licensees have had adequate time in which to modify their operations and fully comply with our rules, although there may not have been sufficient time to obtain the licensing authorizations for repeater station, control station, and/or auxiliary link station. Licensees operating such stations under a previous authorization are cautioned their operations must otherwise fully comply with the rules. Licensees and control operators of stations not operated in compliance are subject to appropriate enforcement action.

An excessive number of problems are being encountered with defective amateur repeater station applications, contributing to wasted effort and length processing delays. The principle problems are lack of standardization, failure to supply the required information, and/or failure to present the information in a manner permitting expeditious processing. Using the experience in processing thousands of these applications, suggest application forms designed to eliminate the most frequently encountered errors, are being developed. Whether these forms will be adopted as official FCC forms is undetermined. However, properly prepared applications based upon these suggested forms will be acceptable for processing. Amateurs are encouraged to develop more universally accepted terms and symbols for use in their applications.

. . .FCC

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

It is easy to blame Mr. Walker for all that has taken place, but in retrospect isn't a good part of it our own personal fault? Most of us just sat back and waited to see what would happen, instead of doing something about it. We looked to people like Wayne to carry the ball for us. We laughed at the idea of a professional Amateur Radio lobbiest fighting for the kind of legislation that would advance our hobby rather than retard its growth. We sat there and per-



WR6ABE's new antenna atop Mt. Wilson.

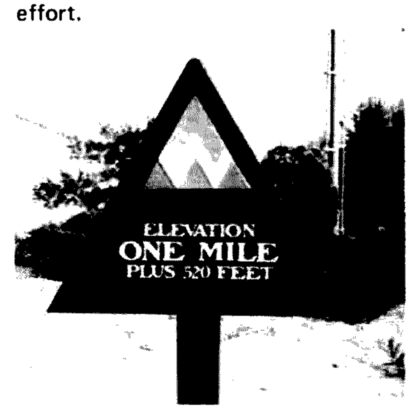
mitted the rug to be pulled from under us. I only hope that it is now not too late to reverse the trend. If we don't our days may be numbered.

What we need is mass public support and an image both recognized and well respected by the general public. We can no longer afford to wrap ourselves up in our own private world of tubes, wires and transistors. We must get out of our shacks and meet the public face to face and convince them that we are a necessary minority in the American society. How? Constact local Civic groups and alike and offer to speak to these groups about what we are and what we can do. Get to know people at one of the local radio or TV stations, and if you are lucky, maybe you can convince them to do a spot or two highlighting amateur radio on their public affairs programs. There are many other ways, both thru the mass medio and direct personal communication. Use your imagination.

Larry K6YLQ, in Oxnard reports to me about one real long haul repeater contact that transpired July 28 and 29, when a number of local amateurs found themselves keying up the KH6EQN 16/76 repeater some 3000 miles west of here in Hawaii. Now that's what I call DXing a repeater. Larry, who is with the WA6SIN repeater group drove up to the site to install a 16/ transmit crystal in the remote base portion of their machine and could hear the KH6EQN repeater atop Sulphur Mountain on his HT. He informed me that some of the other stations in this area who worked Hawaii during this opening were K6DYD, K6YNB and WB6OBB. He has a good part of it recorded on cassettes.

One of the guests who visited my home this summer was Abe Schwartz WB2PQR, Vice President and one of the original founding members of the Kings County Repeater Association. Abe's visit was more than a vacation. I still keep an active interest in my old group back east and I knew that they were in need of some equipment to get ZWP back on the air again. By the same token, I knew that Burt K6OQK, needed a new transmitter for his WR6ABE repeater atop Mt. Wilson. Since Abe and KCRA had access to what Burt needed, and Burt possessed the goodies that KCRA was looking for, a coast to coast swap was arranged and both sides are more than content.

While on the topic of WR6ABE, they now have a new Super Stationmaster and Duplexer for the machine, along with the replacement transmitter. That Stationmaster is at the very top of the tower and has not only extended the already fantastic coverage, but virtually eliminated most of the old dead spots. It took an all night work part to do the installation, but the results were worth the effort.



Just add 150' of tower and 24' of antenna.

It looks like another 34/94 repeater has failed out here. This information comes from the source, the repeater's owner Bill Ogg WA6NGA. Like others in the past his effort to get a 34/94 open repeater going met the same strong opposition from those who use .94 as a simplex channel. After trying unsuccessfully to maintain the .94 output, Bill informed me that for the time being he has moved the output of WR6ABQ to 147.12, while maintaining the .34 input. Whenever the machine was put on the air there were numerous unidentified signals appearing on the input. This "jamming," coupled with the tremendous amount of high power simplex and remote activity already on .94, made the machine useless. It is evident that for the foreseeable future 146.94 will remain simplex. Though this is a loss to the traveling ham who visits L.A., it is evident that the majority of our 2m population seems to favor no repeater on 34/94.

. . . WA2HVK/6

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Activity at AMSAT headquarters is gaining momentum. With OSCAR 6 nearing it's expected lifetime, AMSAT is moving full speed ahead on OSCAR 7. Already funds have been set up and work has begun with an eye toward an early 1974 launch.

Tracking OSCAR 6 can sometimes be a difficult task. Someone has finally come up with an idea to permit amateurs to track OSCAR reliably time after time. William D. Johnston WB5GBG, has devised a plan using some of the characteristics of the satellite's orbit to provide each amateur with a computer printout that details the time the satellite will be overhead, the azimuth and elevation, plus distances for the entire pass. Because OSCAR 6 is in such a stable orbit we can predict orbital data to a very accurate degree far into the future with relatively no loss of accuracy. Furthermore the satellite has a repeating period of 263 orbits which means that the orbital data is the same every 263 orbits. This occurs about every 21 days, so that every 21 days the azimuth and elevation are the same. There are a few discrepancies in this, but the error is only about 7 or 8 minutes over a few months time which is easy to correct. Interested amateurs can write for more information to Bill Johnston WB5CBC, 1808 Pomona Dr., Las Cruses, New Mexico 88001.

If you would like a printout please send your: 1. Name and mailing address. 2. Latitude (indicate north or south) and longitude (east or west) in degrees, minutes and seconds. The local county or city engineer has this information in most areas. 3. Altitude above sea level (in feet or meters). 4. A SASE 9" by 12" or larger (not required for stations outside the U.S.A.) postage should be 48¢ for first class or 66¢ for airmail. The cost is $2.50 for U.S.A., Canada and Mexico $3 for first class and $3.20 for airmail (includes postage) and all other locations $3.50.

Many interesting and unusual operations are being reported from amateurs using OSCAR 6. A few of these are DXpeditions by FP8AA, PJ7VL, PJ9JT and ZK1TA and an aeronautical mobile by W6OAL. OZ7DX reports preparing for maritime mobile operation from the "Dana," a Danish research vessel. RTTY operation has been reported by VK3YDB, G3CUO, W6OAL and WA3EWJ. W9NTP, WA9UHV and SM6OH all reportedly have been active on Slow Scan Television, and WA6GUY reports successful facsimile transmission to WA3FVG/6 via the satellite. In addition, SSTV and audio tone ranging tests have been conducted by DJ4ZC, who uses the data for satellite orbit determination. Finally, all fifty U.S. states have been worked and confirmed by W3TMZ (shown in picture), who qualifies for the first OSCAR Worked All States award.

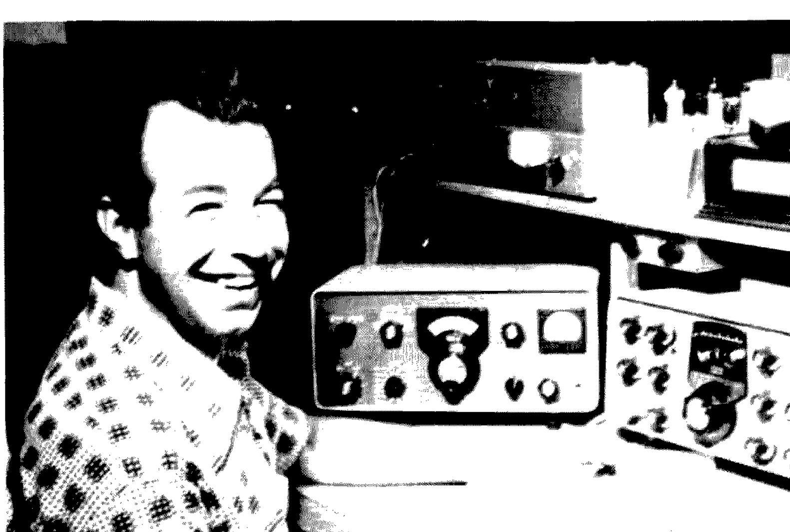
On June 30, AMSAT's board of directors authorized an acceleration of the AMSAT-OSCAR-B satellite project for completion in time for launching during the first quarter of 1974, and authorized additional expenditures (estimated at between $38,000 and $40,000) for the project. The required additional funding covers the salaries of two engineers and two aerospace technicians employed full-time by AMSAT. Also, funds for needed space-qualified components and ground support test equipment are provided by the ARRL and individuals who have made donations specifically for the purpose of completing the A-O-B spacecraft as rapidly as possible. General membership dues and general donations are not being used.

Assisting with A-O-B development are several groups in addition to the Washington area AMSAT members. These include the newly incorporated AMSAT Deutschland e.V., AMSAT's affiliate in Marburg, Germany (under the leadership of Dr. Karl Meinzer DJ4ZC, and Werner Haas DJ5KQ), QIA-Project Australis in Melbourne, Australia (particularly Dr. Peter Hammer VK3ZPI), the Jet Propulsion Laboratory Amateur Radio Club and the San Bernardino Microwave Society in southern California, and a group headed by Larry Kayser VE3QB, in Canada. Other individual AMSAT members in other locations include John Goode W5CAY, who is constructing another Codestore unit.

One final note for the amateur who would like to learn more about satellites and how they work, complete with a history of man's first attempts to orbit such a body. Stanley Macko's book *'Satellite Tracking'* appears to be one of the easiest to understand and one of the most descriptive books I have found.

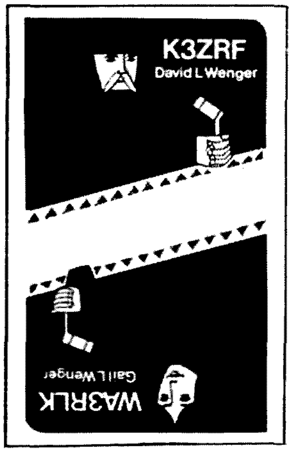
Orbit	Date (Nov.)	Time (GMT)	Longitude of Eq. Crossing °W
4775	1	0008.7	49.8
4788	2	0103.6	63.5
4800	3	0003.5	48.5
4813	4	0058.5	62.2
4826	5	0153.4	76.0
4838	6	0053.3	61.0
4851	7	0148.3	74.7
4863	8	0048.2	59.7
4876	9	0143.1	73.4
4888	10	0043.1	58.4
4901	11	0138.0	72.1
4913	12	0037.9	57.1
4926	13	0132.9	70.9
4938	14	0032.8	55.8
4951	15	0127.7	69.6
4963	16	0027.7	54.6
4976	17	0122.6	68.3
4988	18	0022.5	53.3
5001	19	0117.4	67.0
5013	20	0017.4	52.0
5026	21	0112.3	65.7
5038	22	0012.2	50.7
5051	23	0107.2	64.4
5063	24	0007.1	49.4
5076	25	0102.0	63.2
5088	26	0002.0	48.1
5101	27	0056.9	61.9
5114	28	0151.8	75.6
5126	29	0051.8	60.6
5139	30	0146.7	74.3

. . . WB8LBP

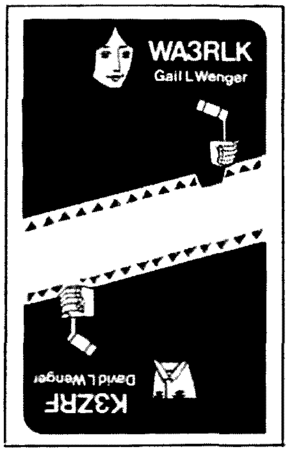


Jack Colson W3TMZ, first to work WAS via OSCAR!

QSL CONTEST



The winner(s) of the November QSL Contest are David (K3ZRF) and Gail (WA3RLK) Wenger of Lititz PA. The total inability of our contest judge to decide which side was actually the top resulted in the card's being reproduced twice. Win a one year subscription! Send your entry to: QSL Contest, 73 Magazine, Peterborough NH 03458.



HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Alan Kline
220 S. Common St.
Lynn MA 10905
598-6010

Ray Calabro
210 Country Club Dr.
Warwick RI 02888
401-781-4084

Greg York
RR 2, Box 434
Three Rivers MI 49093
616-279-2534

Robert White
365 Clinton River Dr.
Mt. Clemens MI 48043
468-4746

Allan Kowal
21-2800 Allwood St.
Abbotsford B.C. Canada
859-7928

John Diecker
9968 Northamton Dr.
St. Louis MO 63137
314-868-2905

James Taylor
1516 Sheley Rd.
Independence MO 64052
816-252-4844

INTRUDER CHASE

Jonathan Tara WB8DBN
16260 Greenfield
Detroit MI 48235

You're sitting there on 7240 having a nice QSO when suddenly your ears get socked with a 50 over carrier. Then, "This is the BBC transmitting to Australia." You grumble, "It's them damn ferren broadcasters again." But what can you do, it *is* legal if they don't point it at us, isn't it? Out of curiosity you look up at the time zone map. "Hmmmm, it's 2:30 in the afternoon in Aust. . .England to Australia?. . .at 2:30 in the afternoon? They're out of their bleeping minds!" What to do? Write to the BBC? Naw, Heaviside was one of theirs, they will claim that the ionosphere never sets on the British Empire. How about the Intruder Watch? That is no good either, they just sit there and *watch.* "Hey Joe, let's move up 5, I can't hear you through Big Ben.. "

Sound familiar? Then, congratulations! You have just given in to an intruder! You are not alone, though. This is the reaction most hams have to intruders. You get mad at first, then realize that there is nothing you can do.

Introducing the 73 Intruder Chase! The Intruder Chase is just what the name implies. It is intended to get rid of intruders *now,* not at the next frequency allocations conference. If we wait that long, as the ARRL seems to be doing, *we* will be the intruders! Before you start yelling at me for trying to dump the ARRL, let's take a look at the intruder situation in general.

Who Are The Intruders?

Take a look at the frequency table. 160m and the first 400 kHz of 80m are allocated in various parts of the world to non-broadcast services. Ah ha! So that's what all those funny

FREQUENCY ALLOCATIONS

Frequency (kHz)	Intruders
1800-2000	Any U.S. or Canadian non-amateur except Loran. Broadcasting anywhere.
3500-3900	Broadcasting anywhere.
3900-4000	Broadcasting to or from Western Hemisphere. Any U.S. or Canadian non-amateur.
7000-7100	Any non-amateur.
7100-7300	Broadcasting to or from Western Hemisphere. Any non-amateur except broadcasting.
14000-14250	Any non-amateur.
14250-14350	Any non-amateur, except for fixed station in the U.S.S.R.
21000-21450	Any non-amateur.
28000-29700	Any non-amateur.

QTH CHANGE?

To be absolutely sure that 73 will follow you to your new QTH, try to notify our Subscription Department at least 8 weeks in advance of your move. Please include your old address and call as it appears on your current mailing label – or better yet, send the label itself.

OLD ADR (or mailing label)

NAME________________ CALL__________

ADDRESS__________________________

CITY____________ STATE_____ ZIP_______

NEW ADR

NAME________________ CALL__________

ADDRESS__________________________

CITY____________ STATE_____ ZIP_______

DXCC NEWS

73 MAGAZINE
PETERBOROUGH
NEW HAMPSHIRE 03458

DXCC Department
ARRL
Newington CT 06111

9 Sep 73

A trouble-making reader has been bugging me about a little DXCC problem — and perhaps you can clarify the situation. He points out that we accept (you accept, I should say) contacts with unlicensed ops in certain countries such as Turkey and Afghanistan. Then, since the UN building should count as a new country, even though it is in NYC (as Vatican and SMOM count in Rome), shouldn't unauthorized contacts from there count for that country? Please advise. To further complicate matters — embassies are on foreign ground too — as are some memorials — will operation from these spots count as more countries? Unless you change your DXCC rules it would appear that you will have to accept these. This could start a rash of HT operations from embassies — perhaps even low powered low band operations, clandestine or authorized. Would official authorization have any effect on the situation?

Perhaps we are on the verge of bringing out several thousand more countries?

73 . . . wayne green

THE AMERICAN RADIO RELAY LEAGUE, INC.

ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U S A 06111

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TREASURER
JOHN HUNTOON
SEC. & GEN. MGR.

QST
OFFICIAL JOURNAL

September 17, 1973

Mr. Wayne Green
73 Magazine
Peterborough, New Hampshire 03458

Dear OM:

Thanks for your letter of September 9.

Sorry to hear one of your readers is making trouble for you. Afraid I can't be much help in clarifying that kind of thing for you. If I could, would I be sitting here at 06:45? However, was reading a book the other day that you might find interesting, if not helpful. The title was "I'm OK, You're OK."

Presuming you've read it, that bit in it about the games children play having to do with things like:...what would you do if you found yourself standing in the middle of a pool of liquified crud, up to your chin, and someone threw a bucket of slop at you?...sounds pretty much like what your reader is asking you. If you start from that point and take on from there, it may clarify the situation for you.

73-DX,

R. L. White, W1CW
Assistant Communications Manager

RLW/fr

SINCE 1914 — OF, BY AND FOR THE RADIO AMATEUR

bleeps and bloops are! Unfortunately, those bleeps and bloops are legal. A common intruder in this part of the amateur spectrum is your local broadcast station — one of it's harmonics. For some reason, this seems to be worse during the day. Maybe that is because more "cheapie" stations are on during the day.

40 METER PICNIC

requency	Station	Time	Language
050	R. Cairo (V. of the Arabs)	0300-0800	Arabic
065	R. Tirana	0430-0500	Arabic
090	R. Tirana	0430-	
120	R. Peking[1]	0100-0155	English
150	R. Moscow[1]	0100-0500	English
150	BBC[2]	0545-0915	English
240	BBC[2]	0545-0915	English

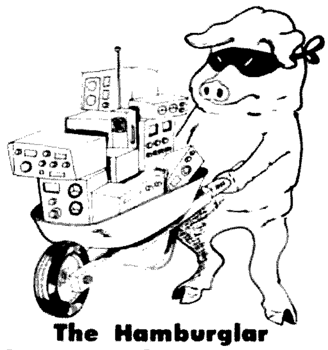
North American Service
Australian Service

40m is where the *real* fun begins. 7000 to 7100 kHz is an exclusive amateur band world wide, although you wouldn't know it by listening. *Anyone* other than an amateur caught between 7000 and 7100 kHz is illegal. 7100 to 7300 kHz is allocated to the broadcast service in the Eastern Hemisphere. The "catch" here is that they are not supposed to broadcast to the Western Hemisphere. Of course, this rule is not always observed. Some stations, like Radio Moscow, will come right out and say, "North American Service," in their schedules and on the air. Others are more sneaky, like the BBC case cited above. A good indication as to where they are *really* broadcasting to is where the letters on their mailbox program come from. If all the letters are from Podunk, Iowa, and they claim the broadcast is going to Outer Slabovia, you know there is something fishy. If there is a band on everyone's *WANTED* list after 220, it must be 40.

Intrusions occur less frequently on the higher bands, but they still happen. Usually the intruders on the higher bands will be "utility" type transmissions (Teletype, FAX, etc.). I remember once that there was a huge multiplex teletype signal parked on 20m. It had a signal every 2½ kHz from below 14000 up to about 14250! Another type of intruder in the higher amateur bands is harmonics from broadcast stations on lower frequencies. Thus, the same signal that is creating havoc on 40 can be QRMing 20 at the same time. After complaining to the BBC about a harmonic of theirs on 20m, they apologized and said that they had reduced the level of the harmonic 6 db, while at the same time maintaining that they did nothing illegal in the first place!

Next month I'll discuss what can be done about intruders. In the mean time, if you want to know more about the Intruder Chase drop me a line. I plan on an Intruder Net, so if you are interested in the net, please let me know so we can get one started. Also, if you have any "contributions" to the intruder list, please send them in.

WB8DBN



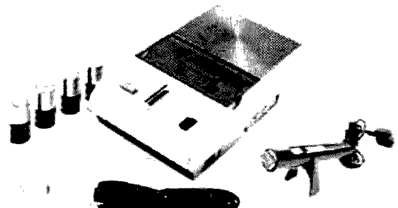
The Hamburglar

STRIKES AGAIN!

AF68 No. 10888	K5LKL	1/73
PMR8 No. 10918		
M1070 pwr supply		
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA6WOA	4/73
NPC 107m pwr supply		
2, 5AJ-IPL Onan Gen., No. 327885		
R4B No. 11578G	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8390		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0653556		
HR-2 No. 04-C2879	W6GSR	6/73
SB-34 No. 211828		
STD 826 No. 011268	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G12279/CW	W4GF	7/73
HR-2 No. 0302030		
Clegg 27B No. 72013-1068	W3BXL	7/73
Std. 826MA No. 208078	WB2DEW	7/73
Drake ML-2 No. 10582	W3MSN	8/73
Tektronics 453 Scope	WB2FZU	8/73

NEW PRODUCTS

CASSETTE RECORDER SPECIAL



combination ac or self-contained battery operated cassette recorder — with the new one control feature instead of the old piano key type control.

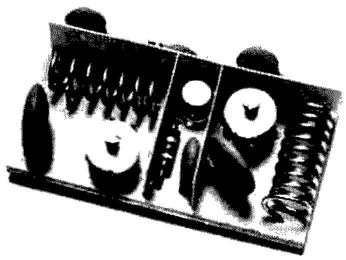
This cassette recorder is ideal with 73's code course since it can be operated anywhere — at home — in the car — in the office (maybe in the drawer, with the earphone for silence). The single control switch is excellent for use in the car where you don't want to have to take your eyes off the road to use the recorder — to operate it for copying in your mind — for instant rewinding or fast forward. And this control doesn't have to be held either, a nuisance on most recorders.

Comes complete with four "D" batteries, ac power cord (plugging it in disconnects the batteries), earphone (you can even copy code without bothering the wife or family), and mike so you can make your own recordings of rare DX off the air when you get your license.

This cassette tape recorder is available for only $23.95 (plus $1.00 for

shipping and handling) to help you with our code course. Order it from 73 Magazine, Peterborough NH 03458.

2 METER PREAMP



Data Engineering has come out with a nice 2 meter preamp using Mosfets. We installed one of the preamps on the 146.19 receiver at 73s WR1AAB Repeater and were very, very delighted with the results. Tests showed about 20 dB gain and a noise figure of less than 2.5 dB. To put it another way, before the preamp was installed our receiver was exhibiting .4 μv for 20 dB quieting. With the preamp in the line the receiver is now good for .1 μv (20 dB quieting). That does make a receiver super sensitive. Contact *Data Engineering, 554 Port Royal Rd., Springfield. VA 22151.*

TOUCH-TONE DECODER

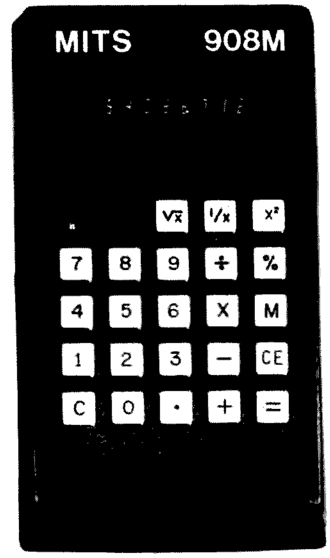
It looks as though the age of Repeater Sophistication Devices is here. Although Touch-Tone has been used on repeaters for some time, until recently decoding was done with the aid of either one of Ma Bell's decoders, such as the 247B, or a decoder built up by some enterprising individual at a rather healthy price. Now however, one can find the perfect answer to Touch-Tone decoding. Data Engineering introduces their DE2171 Touch-Tone Decoder. Simply apply 5 volts and receiver audio to the decoder and you are all set to decode the standard 12 button Touch-Tone functions. The Data Engineering decoder has some very nice features. Probably the one thing about the decoder, in addition to it's small size and layout, is the fact that the output from the decoder is via reed relays. If you have ever "zapped" a nice solid state device with a transistor logic output, you'll have no problems with this decoder. The reed relays, though small, can take just about all you can hand them. All in all, thanks to Data Engineering for a small Touch-Tone Decoder with all the features you could want at a price less than what you would pay for one of Ma Bell's units. If, of course, the Bell units were ever for sale. Contact *Data Engineering, 554 Port Royal Rd., Springfield VA 22151.*

MITS CALCULATOR

Very handy, one might pun.

Like many of the newer gadgets available, once you get one of these hand calculators the chances are that you will find yourself using it every day and wondering what you did before you had it. Like Kleenex. There was a time when there was no Kleenex. Some of the old timers may remember those olde days.

The recent MITS ads have been featuring their 150-series calculators. A rather thorough research of the available calculators – and there are a great many on the market these days – indicated that only a couple had the recently developed memory circuit. Users of any of the older calculators



will readily appreciate the importance of this for in any complex computation it has been necessary in the past to write down intermediate figures and then enter them later.

For instance, suppose you want to add 15% of $200 and 15% of $375? No longer do you have to do the two calculations separately and then add the results, with the new circuit you can do the 15% of $200 and then put it up in the memory while you do the 15% of $375 – and then add the memory number to the second calculation.

The number in the memory can be used for addition, subtraction, multiplication or division. Thus, if you have a series of discounts that you want to take on a series of prices, you can put the total discount perdentage in the memory and use that to multiply the prices. Reading out the memory does not erase it, so you can make a long series of calculations quickly.

The 150 also has a clever system for setting the decimal and rounding off numbers. By touching the (.) (=) (2) keys you then end up with all calculations rounded off to two decimal places.

The X^2, 1/X, and $\sqrt{}$ keys are great for many radio and electronic problems. You can whip off a $1/62.79^2$ in a flash. And you certainly don't need to cart around decimal equivalents of fractions anymore. The conversion from English to metric is fast with the calculator.

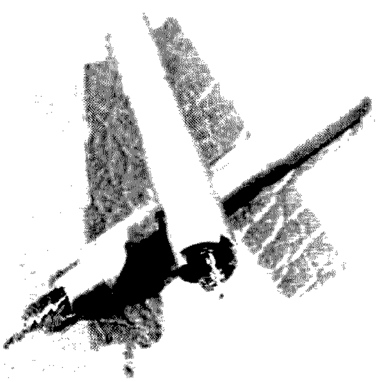
The % key is a small bonus for people who are not sure what a percent is and don't know that they'll get the same result by multiplying by the % number with a decimal point in front of it. 15% of $375 can be done either by (1) (5) (%) (3) (7) (5) (=) or (.) (1) (5) (X) (3) (7) (5) (=). Well, you save punching one key.

There is a clever little battery saver circuit which turns off the readout numbers after about 15 seconds and indicates this with a little LED dash. Touching any key brings the figures back.

The MITS 150 is getting closer and closer to the Hewlett Packard unit, but without all those things that only a physicist might need. The 150 sells for about $130, or for $100 in kit form. The kit isn't all that difficult to manage, if you want to save $30. And, at $100, you will be hard put to find anything approaching this calculator anywhere.

Contact *MITS Inc, 6328 Linn Ave N.E., Albuquerque NM 87108.*

INSTANT CIRCUIT BOARDS



A set of drill mills are available which allow quality circuit boards to be fabricated from copper-clad material by simply drilling holes! Each mill, when powered by a hand drill or push-screwdriver, drills a small hole in the board and isolates a bit of the copper clad around the hole for soldering purposes. Three sizes are offered so the size of the isolated pad may be matched to the components you are using and the degree of miniaturization with which you are struggling. The largest is suitable for mounting standard sized components while the smallest can be used to fabricate mountings for in-line IC packages.

The drill-mills are extremely easy to use. After an outline of parts placement is drawn, the location of each proposed pad is marked through the layout onto a piece of copper-clad with a center punch, ice pick or other common workshop item. Then go to it with the drill-pads. If there are only a few holes to make, one needn't even get out the drill. The mills are extremely sharp and pads can be made in most board material at the rate of two per minute with only a large knob mounted onto the shaft and a little wrist action. This method lends itself nicely to the "plan-as-you-build" school of construction and also to experimenting. . .mount a component – decide where the other lead will fit best – then drill the small isolated pad.

Unlike working with normal P.C. boards, isolated-pad circuitry can easily be modified. Since connections between components are not etched but wired, a little work with a soldering iron can change things around considerably without ruining the board. These little drill-mills are truly an experimenters tool!

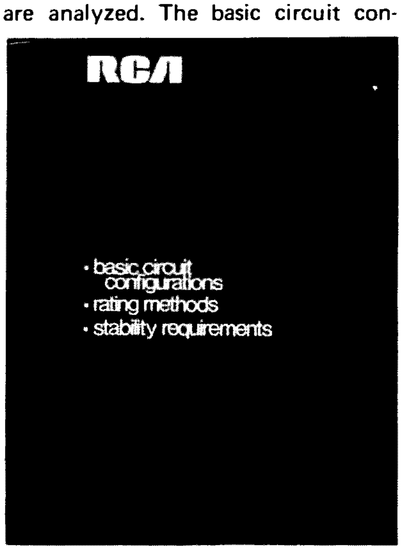
The three sizes availalbe will make isolated pads 0.20, 0.15 and 0.10 (inches) in diameter. Each is supplied with its own internally mounted no. 60 drill, which can be easily replaced. The price is $6.95 each.

For more information contact *A. F. Stahler Co., P. O. Box 354, Cuertino CA 95014 402-262-4219.*

POWER AMPLIFIER BROCHURE

A 20-page brochure that describes basic concepts and techniques employed in the design of transistor audio power amplifiers and 38 silicon power transistors specially selected for use as input, driver, output and overload-protection devices in such amplifiers are available from RCA Solid State Division.

RCA Publication No. APA-550, "Audio Power Amplifiers," describes significant design features, basic circuit configurations, rating methods and stability requirements for transistor audio power amplifiers. The classes of amplifier operation and selection of the optimum class for a given output-power level are discussed, power-amplifier drive requirements are defined and the effects of operating conditions on circuit design are analyzed. The basic circuit con-

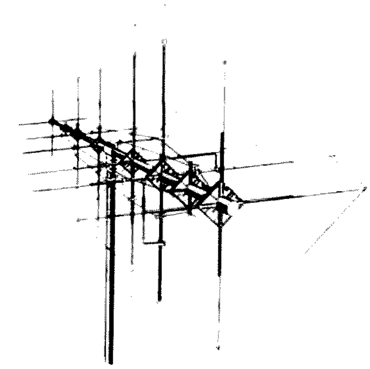


figurations used for audio-output stages are evaluated. The methods used for rating audio power amplifiers are compared and the power-output and dissipation capabilities of class B audio amplifiers are explained. The effects of changes in temperature, or large signal phase shifts and of excessive levels on amplifier stability and the techniques used to compensate for these effects are pointed out, and methods used to protect the output transistors against short-circuit load conditions are shown.

Anyone wishing to firm-up or expand their knowledge of audio amplifier design is invited to write for their copy of APA-550. Contact: RCA Solid State Division, P. O. Box 3200, Somerville NJ 08876.

2KW CB ANTENNA ANNOUNCED!

(hmmmmm . . . .)



A new "super power" CB base antenna has been announced by Avanti R & D. Called the MOONRAKER 6, it is a 6-element, dual polarity beam combining five sets of crossed dipole type elements plus a quad type reflector for better rejection and gain. Tunable gamma matching on both the vertical and horizontal elements handles over 2,000 watts of power(!), gets the lowest possible SWR, is said to provide excellent lightning protection and to be virtually trouble-free.

In addition to the exceptionally high power potential, Moonraker 6 specifications include 17 db gain over isotropic, 44 db rejection, 24 db side rejection, and 1.2:1 VSWR. Contact: *Avanti Research and Development, 33 West Fullerton Avenue, Addison IL 60101.*

ALLIED ENGINEERING CATALOG

Allied Electronics (Division of Tandy Corporation) has published their new 1974 catalog #740. Previous catalogs have served as the electronics industry's "answer book," and the new catalog is even better. The prime feature of the Engineering Manual & Purchasing Guide catalog is the includ-

(Continued on page 111)

GETTING STARTED ON 450MHz

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

The Basics -

- *Crystal Controlled Signal Generator*
- *Modulator*
- *Infinite Attenuator*
- *Wavemeter*

This article describes a good crystal oscillator signal source for 450 MHz FM work. It is one of a series on how to get going on 450 MHz FM. You have to work a little harder on this frequency, and this series will be of help You must have – or make up – certain pieces of test equipment to help you get into the UHF region. But the real amateur fun you will get out of it, if you have even a drop of experimenter's blood in you, will be well worth your while.

General

This 450 MHz crystal controlled source is about as simplified and straightforward as you can get on 450 today. All three stages combine the results of many years of past work on my part, beginning in 1946 with an article entitled "Getting Started on 420." History does seem to repeat itself.

There are many pitfalls along the way to a really good signal source, surefire and reliable, on 450 MHz, and we will guide you through them, with luck, and you can go on from there. If you make this rig exactly as shown, it will provide you with a good signal source from 420 to 450 MHz, by changing crystals and retuning very slightly. You can use it first of all as a signal generator and by sliding it into an aluminum tube (as shown in Fig. 5) you can add an infinite attenuator to it. This will allow you to make repeatable low noise, high sensitivity tests on any receiver you build for 450 MHz. You can also use it as a guide for an L.O., or as the beginning of a one watt or more FM rig. I used a 48 MHz crystal because, being an old 2 meter DX'er, I have a lot of rocks lying around near the band edge. The 50 MHz one comes from my old 6 meter days.

Figure 1 shows the entire signal source. Note the simplicity throughout: all tuning

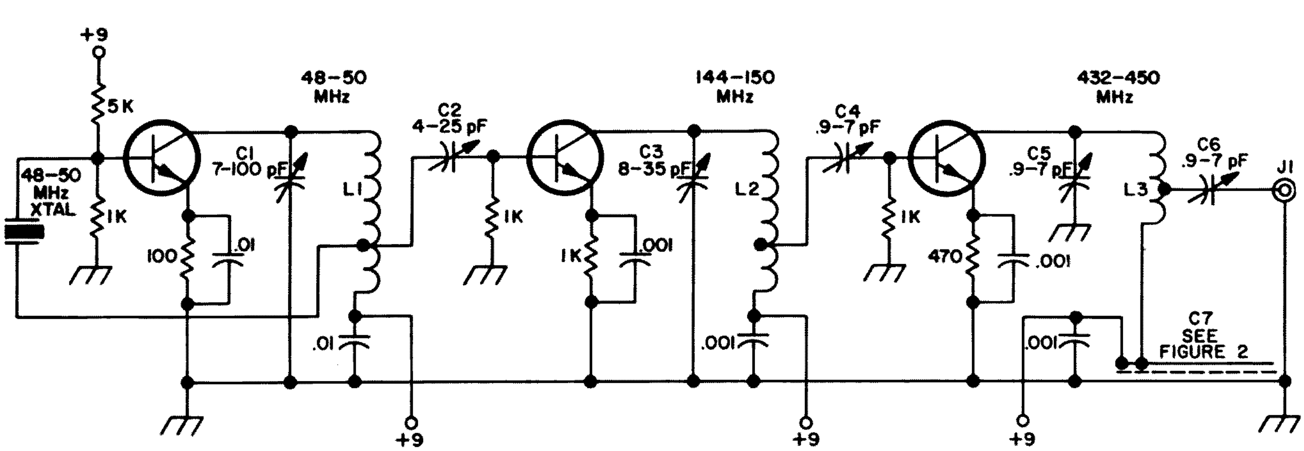


Fig. 1. 450 MHz signal source. All transistors are HEP 75. L1, 20 turns No. 24, 8mm long, 5mm diameter form. Tap at 8 turns from cold end; L2, 5 turns No. 20 tinned copper, 19mm long, air-wound, 8mm O.D.; L3, 3 turns No. 20, 11mm long, 5mm diameter. Tap in center.

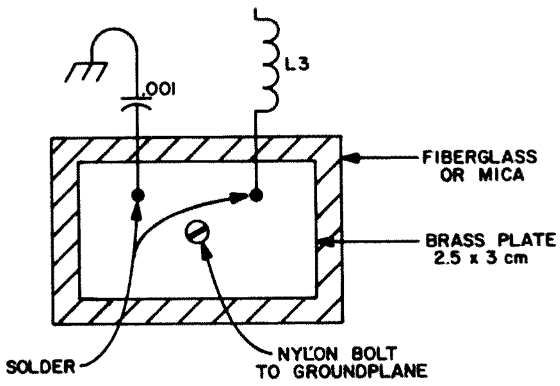


Fig. 2. Special UHF capacitor C7.

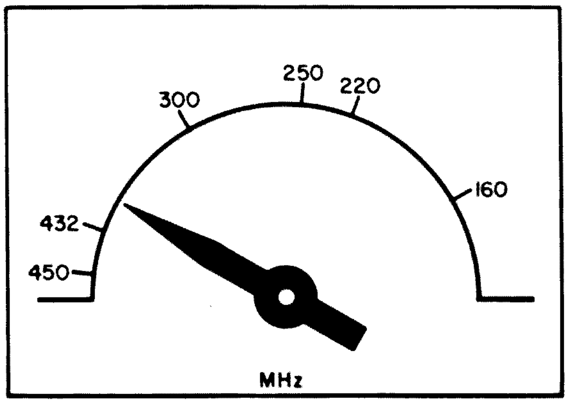


Fig. 3b. Front panel calibration for the wavemeter.

capacitors are mica compression Arco's, only three tapped coils, all base input capacitors are variable, no external bias needed on the two triplers, three similar transistors, HEP 75's, and only one special item, which requires a nylon bolt and nut.

Crystal Oscillator

This puts out enough power to drive the tripler base without external dc bias. Rf voltage at 48 MHz is developed in L1, tuned by C1. Remember, it is much simpler to describe oscillators when they are already running, and this one always will be if you make it as shown. The rf voltage is fed back in phase to the crystal. This of course is the wrong phase for the base, but the crystal has – at any given instant – plus on one side and minus on the other, so the base receives the rf voltage correctly out of phase, resulting in good, powerful, stable oscillation. Both the crystal and the base input of Q1 are of low impedance so the match is continued with a tap down on L1 for the feedback connection. I usually tune up the oscillator with a two or three turn link out of L1 into a tuned diode receiver on 48 MHz, which in this case showed some 20 to 30 mW output.

The First Tripler

A trimmer, C2, couples 48 MHz energy over to the base of Q2 in sufficient quantity so that no external dc bias is needed. L2 and C3 are tuned to 144 MHz. Be very sure you are on 144 and *not* on 96 or 192! Again, use a tuned diode receiver and an absorption wavemeter or a dipper in the diode mode.

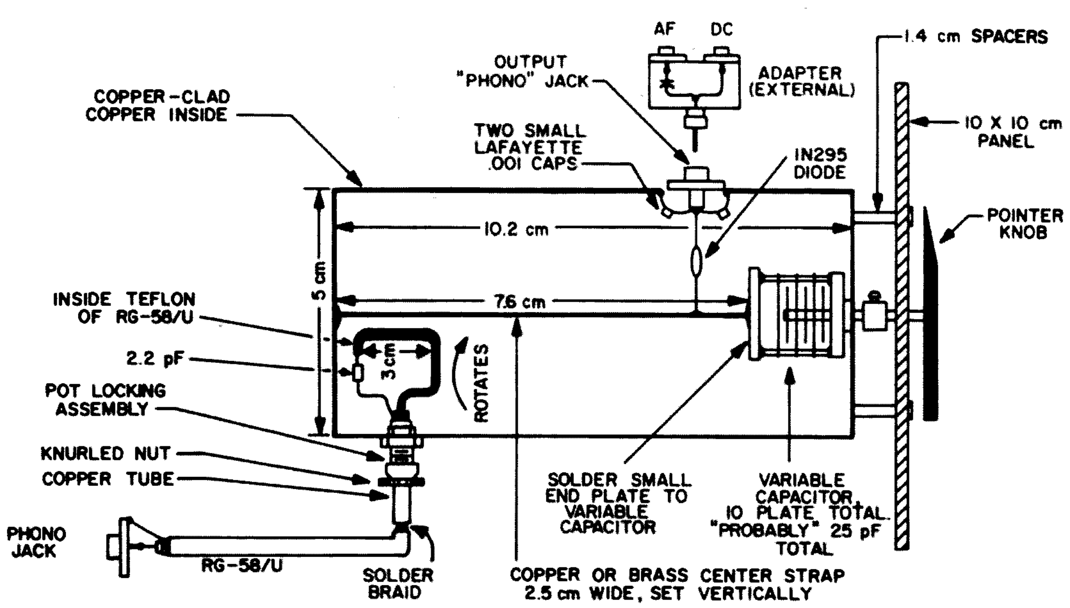


Fig. 3a. 150-470 MHz wavemeter.

Play around with C3 and L2, making sure it is on 144 MHz and that it does tune smoothly without discontinuous jumps and bumps, and that it does *not* affect the oscillator.

The Second Tripler, Q3

Almost the same story as the first. Just pay a little more attention to short leads and to the special capacitor you need for the collector return of Q3, C7. In order to have the +12 return lead of L3 properly bypassed to the baseboard ground so that 450 MHz energy circulates correctly around the C5-L3 circuit, I generally use a flat brass plate capacitor, insulated from the baseboard as shown in Fig. 2. This is a very useful type of capacitor to know about, especially if you are going up later to 1296 and higher. I also bypass the bypass with one or more tiny, ultra-short lead .001 capacitors from Lafayette. These even work (sometimes) at 1296. They keep lower frequencies from sneaking through C7. Don't forget there are plenty of these low frequencies lurking in the output of Q2, just waiting for a chance to show. Don't say I didn't warn you! Now you must have a good diode receiver and/or a good absorption wavemeter for 420–450 MHz. A friend of mine, 10 to 15 years in VHF, built a 432 MHz receiver and could not hear anything on the band for a week. No wonder – his L.O. was off one harmonic away from where it should have been! Figure 3 shows the exact dimensions of the

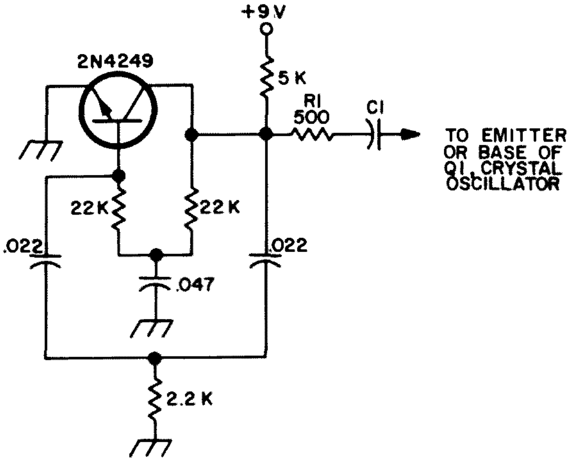


Fig. 4. AF oscillator modulator. The frequency is about 400 Hz, as shown. Adjust R1 and C1 for modulation needed. Any good AF transistor may be used.

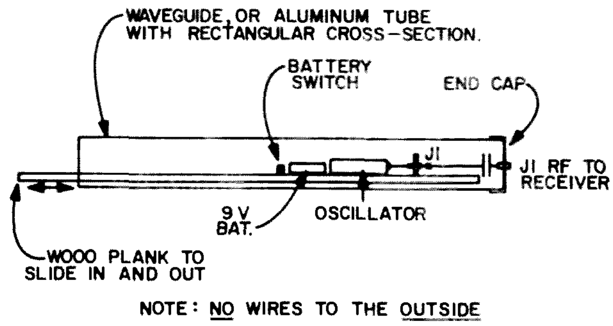


Fig. 5. The infinite attenuator.

diode receiver I use. I have used this one for years on 220 as well as on 420 to 450 and it is very reliable. With this handy piece of test equipment plugged into J1, the 450 MHz output jack, you should begin to get some output. Be sure and get 144 MHz energy into the base of Q3 via trimmer coupling capacitor C4. Then, by playing around with C5, L3, and C4 you should be able to build this up to a good ½V dc output from the diode receiver. With a 50 μA meter plugged into the output of this receiver, you can read nicely even small amounts of rf as it starts to arrive during the tuning. I usually put a 10K

pot in series with it, with calibration marks at .1, .5, 1..and 5V for handy use. Build up carefully the 450 energy, watching the 48 and 144 tuned circuits as you go. It's very easy for them to jump around if you use coupling that is too tight, via C2 and C4. I often use two or more tuned diode jobs to keep an eye on those lower frequencies. You can't be too careful. Always use only enough coupling capacitance to get maximum energy into the base concerned and no more. Even a little less than maximum for the smoothest and safest all-round best tuning. Do not leave this source in a marginal operation,jumpy, condition. Remember, you are the one who is going to depend on it to tune up your 450 gear. You could get more output by substituting a 3866 for the HEP 56 as Q3, the last tripler, but as this is intended only as a signal source, you don't really need it.

Modulation

A little tone, mixed FM and AM, never hurts in a signal generator, so a convenient little af oscillator plank is shown in Fig. 4. This can be connected between ground and the emitter of Q1, the crystal oscillator. Attach it to the base for more modulation through a resistor.

Infinite Attenuator

This one has been shown several times in *73*. Just mount the whole generator including the battery and switch on a long plank that will slide easily into a piece of aluminum waveguide or a piece of aluminum, rectangular cross-section, rain-gutter downspouting as shown in Fig. 5, and you can go down to a tenth or even a hundredth of a microvolt.

Conclusion

A simplified homebrew 450 MHz signal source has been described, along with a modulator and mention of an infinite attenuator. This could start you off on an interesting series of 450 projects planned to include receivers, transmitters and antennas. Don't forget, there are transistors available today with noise figures of 1½ dB at 500 MHz.

. . .K1CLL

GETTING STARTED ON AMATEUR TELEVISION

With a handfull of transistors and an old TV set!

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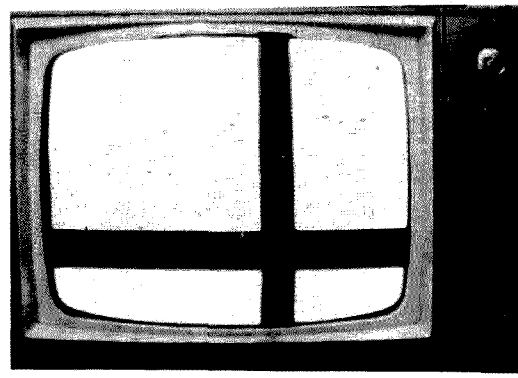


There are many ways to get on the air in ham TV. This article shows simple and graduated methods of transmitting TV. The first thing to have is a monitor. Then you can transmit your vertical and horizontal sync. Now you are on amateur TV. Next you can fill the picture with bars, dots, crosshatch, etc. If your resources are not too limited, you can build the simple flying spot scanner or a vidicon camera. This article shows the simplest ways to do these things with transistors; it is meant to be an idea article – to give you ideas on how to build up your station.

The Monitor "Jeep"

Of course you want to see your signal before you transmit it. The best way is to get an old TV set (no ac-dc models!) and disconnect the rf and video i-f, and connect your video output to the grid of the video amplifier. You can use the family set if you just insert a shorting phone jack between the detector diode and the grid. Then you can just plug in whenever you want. All you do is pull it out, and it's a TV set again. The signal level at this grid is compatible with the video output amplifier, generally 2V peak-to-peak, with negative going sync.

Sync Generators

Before anything can be done in video design, vertical and horizontal sync as well as composite must be available. The stability of the system is dependent on the quality of the sync generators. In simple, inexpensive designs many tradeoffs can be considered: random or interlaced scan, crystal control or free running, serrated vertical sync, color burst, blanking, etc. Many of these are elite, but more than necessary to the beginner. The use of complex frequency dividers and critical tuned circuits is eliminated by random interlace and multivibrators. Furthermore, the circuits lend themselves to integrated circuit techniques.

Vertical Sync

A 60 cps sine wave is derived from the power supply and squared off in Q1. The negative going edge of the square wave turns off Q2 for a time determined by $T = .7RC = 7\gamma\ (100{,}000 \times .02 \times 10^{-6}) = 1.4$ milliseconds for a standard 10:1 ratio of sync to scan time. The emitter followers give a low output impedance terminal capable of driving coax lines with 12V logic levels. The 2N3704 and 2N3702 are used for high gain at low cost.

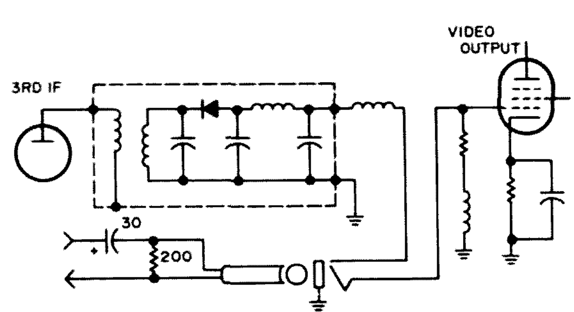


Fig. 1. An old television set can be used as a monitor by tapping into the grid of the video amplifier.

Horizontal Sync

Digital techniques here can eliminate tuned circuits and unstable blocking oscillators. A simple multivibrator is set to produce

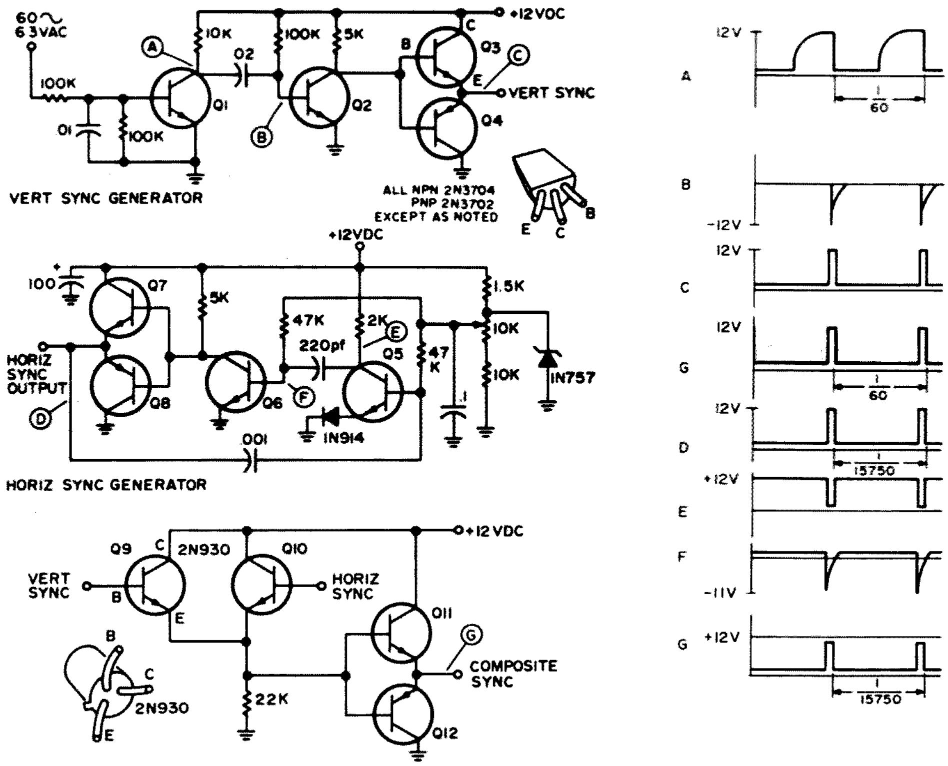


Fig. 2. Sync generator circuitry and representative waveforms at the test points.

a ratio of 7:1 scan to sync time. This is lower than the standard 10:1 ratio, but is more stable at starting and requires less deflection power. The time intervals are also determined by T = .7RC, but are significantly variable by the 10K "frequency" potentiometer. This zener regulated variable voltage gives stable protection against line voltage changes, and allows precise setting to 15750. The frequency range available is actually 11 to 18 kHz. The emitter follower pair serves two purposes in this circuit: both as a line driver and a signal squarer. Normally the collector resistor and the capacitor connected to it limit the voltage rise time, and an unsymmetrical wave often never squares off at the top. The emitter follower pair squares it off. The diode in the emitter of Q5 prevents excessive reverse breakdown currents in the base.

The composite output is generated by "or"ing the vertical and horizontal sync pulses in 2N930 Q9 and Q10. The 2N930 was chosen for its high gain, so that it would cause little load and the horizontal oscillator would not pull during vertical sync and

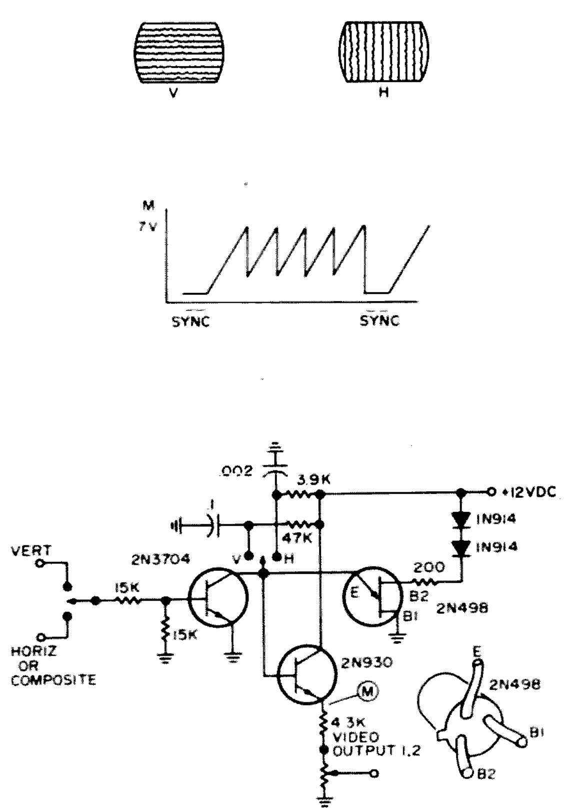
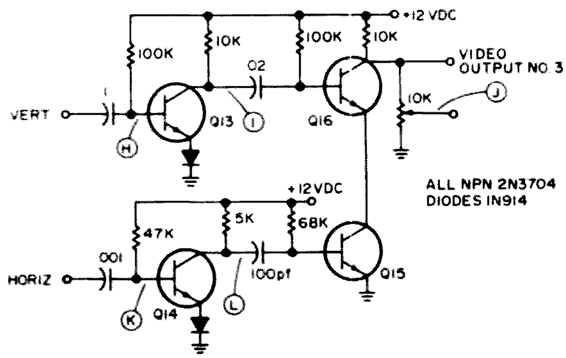


Fig. 3. Vertical and horizontal bars can be generated with this circuit for checking sweep linearity.



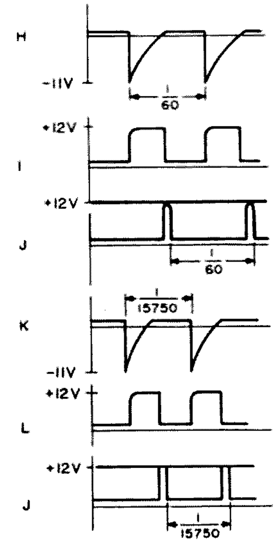


Fig. 4. Schematic of the T-generator circuit and the various waveforms within.

cause severe "tear." The emitter follower pair was again used for a line driver.

Vertical and Horizontal Bars

Vertical and horizontal bars are useful in checking sweep linearity. A unijunction with emitter follower gives the entire gray scale in between bars and thus helps adjust modulation percent. This circuit is easy to adjust, since the rc time constant sets the number of bars per frame with sync from the appropriate sync generator to lock the bars in place. The 70 kHz upper limit of the unijunction limited the pattern to only 5 vertical bars. The diodes in base 2 of the unijunction improve ramp linearity.

T Generator

Now that vertical and horizontal are available, many things can be done. Locked oscillators can generate vertical and horizontal bars. Oneshots can shift signals from one side of the screen to the other. Pictures can be turned off and on.

The negative edge from the horizontal and vertical sync turns off Q13 and Q14 respectively for an RC time constant which then come back on. When these turn on, they turn off Q15 and Q16 for a very short time. When either turns off, the collector voltage of Q16 goes up, and this is the video output terminal.

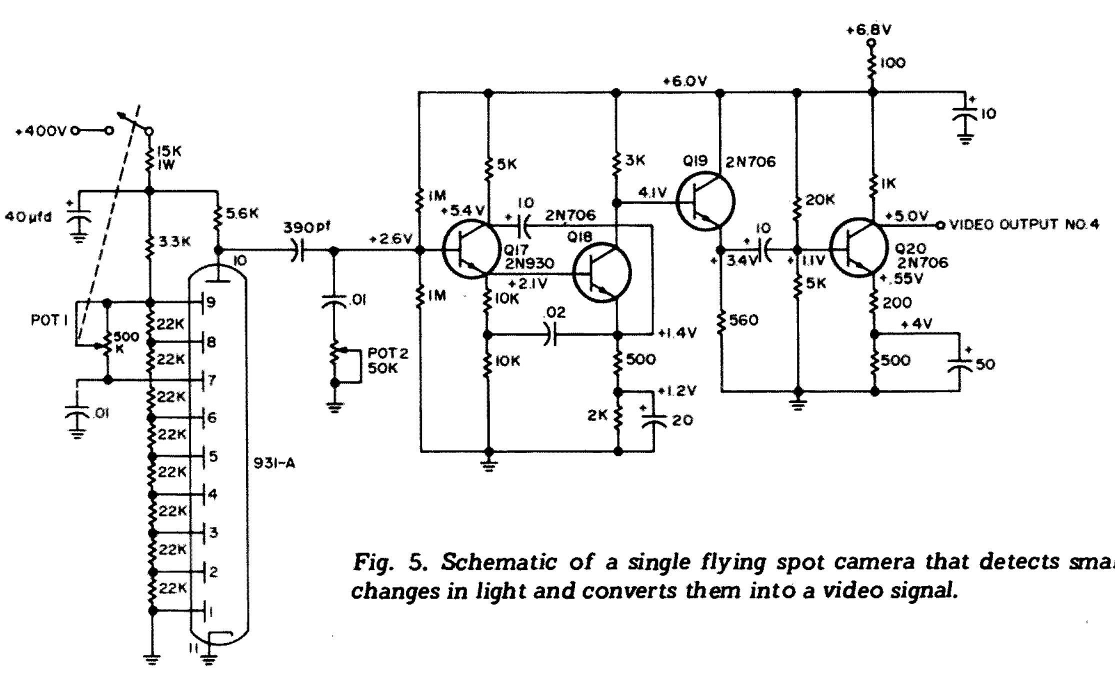


Fig. 5. Schematic of a single flying spot camera that detects small changes in light and converts them into a video signal.

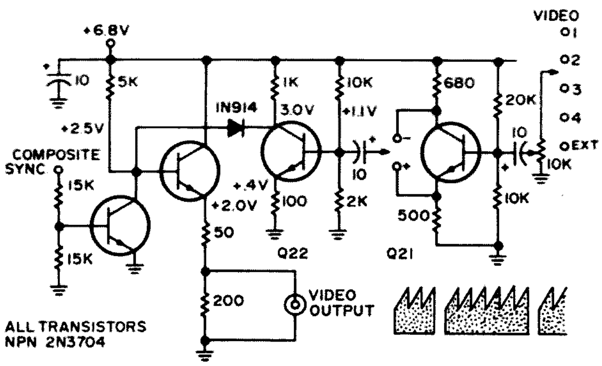
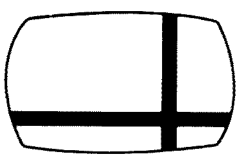


Fig. 6. The video output stage adds the composite sync signal to the video and produces a 1V signal suitable for modulating low powered rigs.

By delaying the vertical sync pulse approximately ½ frame and delaying the horizontal ½ scan, then adding the signals, we get this:



The circuitry is simple, and the signal is eye-catching as well as good for aligning the rig.

Flying Spot Scanner

Patterns are fine, but it is also desirable to transmit "live." A camera requires expensive tubes and deflection circuits which are difficult to make work properly. Worse yet, there are so many knobs to adjust. A flying spot scanner can transmit live using a TV set to scan across the image. The sync information can be transmitted to the set on an unused channel or jeeped into a monitor (connected to the set after the video detector). The TV set scans a white raster; the image (crayon or electrical tape on Saranwrap) cuts off the light. A light sensor picks up the variations in light. No available semiconductors could respond fast enough to high frequency video, so a photomultiplier tube was used. With this method, no lens system is needed. Pot 1 adjusts the sensitivity of the tube. Too sensitive, and the edges of the pictures are dark; not sensitive enough and no picture. Pot 2 compensates for the finite decay time of the phosphors which shows up as smear on the set. While adjusting this pot the signal level will go down and must be companesated in Pot 1. Q17 and Q18 form a "bootstrap" amplifier; a method of getting constant high input impedance at high frequencies with transistors. Q18, Q19 and Q20 make a wideband video amplifier with *no* coils.

This is the thing for test patterns, call letters and calling CQ.

Video Output Amplifier

The final step of the video chain is the sync inserter. In this design Q21 is a phase inverter for positive or negative video. Q22, the final stage of amplification, drives Q23 emitter follower for a low output impedance. Q24 and the diode in its collector insert composite negative going sync. The output is standard 1V negative going sync suitable for modulating a low power rig and the monitor.

The TV Transmitters

The remainder of the video system includes the aural carrier, generator, and the UHF transmitter. It may also be necessary to monitor video without a direct connection to the monitor. A channel 3 transmitter is described which operates on standard 1V peak-to-peak negative sync, and can be placed anywhere in the line. A channel 10 or channel 11 transmitter is also described for use with the flying spot scanner described earlier. Its purpose is to transmit composite

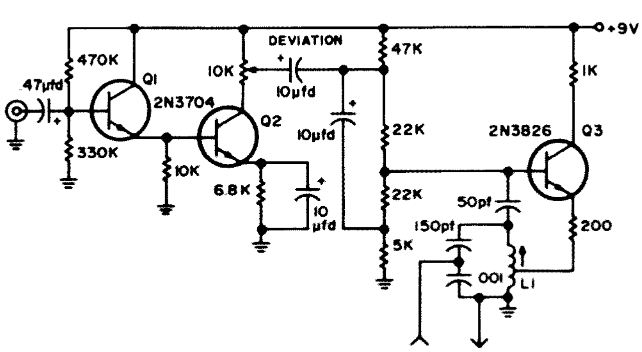


Fig. 7. Aural carrier generator. The 4.5 MHz FM output of this circuit can be mixed with the video signal for simultaneous transmission of both audio and video information. L1 – 50 turns, 2 strands of No. 36 in parallel on 3/8 in. (std) slug tuned form. Tap is 20 turns from ground.

sync information to the scanning source TV set. With little modification it could be used as a video transmitter. The major goal to the ham radio operator is to transmit the video information in the 435 MHz region. Two UHF oscillators are discussed with their pros and cons and problems.

The Aural Carrier Generator

There are two ways of transmitting audio with video. One method is to have a transmitter 4.5 MHz higher in frequency than the carrier of the video; then frequency modulate it with 25 kHz deviation. This system requires two transmitters and two antennas. The other way is to generate a 4.5 MHz carrier with 25 kHz deviation and mix it with the video before the modulator.

The second system requires a very high deviation to carrier ratio: 5.56 x 10^{-3}, compared with .75 x 10^{-3} for commercial FM, and .1 x 10^{-3} for narrow band FM. Once generated it can be mixed with the video on the 1V peak-to-peak line requiring only .1V for the standard 10% video to audio ratio.

This circuit uses a Darlington amplifier for a high impedance microphone, and a conventional Hartley oscillator modifier for wide frequency modulation. Frequency modulation is accomplished in this oscillator by changing the interelectrode capacities of the transistor Q3.

The Composite Sync Transmitter

For the flying spot scanner, a TV set must be "in sync" to generate a scanning raster. A simple off-on transmitter will do the job, being on during sync and off during

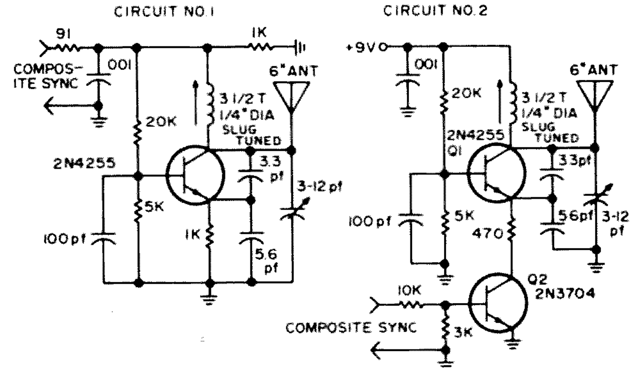


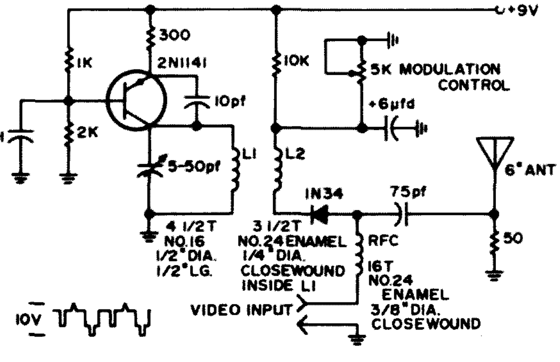
Fig. 8. Two simple composite sync transmitter circuits.

scan. The frequency can be adjusted to any unused channel. In this case, it was adjusted in between channel 10 and channel 11 to avoid interference.

Circuit #1, the original circuit, is a flea power oscillator, deriving power from the composite sync terminal. This circuit caused several not too serious problems, however:

1. Time for capacitors to charge delayed sync and shifted resultant picture to the right. (This can also be caused by overscan in the scan source.) This can be overcome with very small bypass capacitors.
2. The slight difference in amplitude between horizontal and vertical sync caused the vertical and horizontal to be transmitted on different frequencies, making it hard to sync the TV set.

These problems were solved with one more transistor as shown in circuit #2. The lower emitter resistor allows it to oscillate at higher power. Constant voltage on the collector keeps the frequency from shifting. The transistor Q2 turns the transmitter off



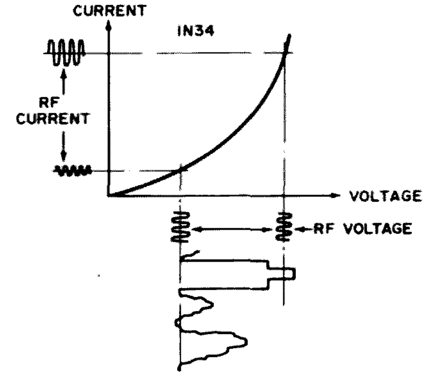


Fig. 9. A monitor transmitter for channel 3. See text for details on adjusting the modulation control. Modulate this circuit with Fig. 6.

and on, and since there is no capacitive load in the composite sync signal path, the sync signal is not delayed, and the picture is not shifted.

Monitor Transmitter Channel 3

This transmitter uses the same basic oscillator as the channel 10 sync transmitter. Operating with a 70 mW carrier the germanium diode is biased into conduction with current from the standard video line. As current in the diode increases, its resistance goes down and passes more rf to the antenna. As current decreases, the diode goes toward "cutoff" and doesn't conduct the rf voltage (see graph). The potentiometer is adjusted near the maximum voltage or white level and thus gives 100% modulation. This transmitter can be placed on the video line but is not a termination, so another monitor transmitter can also be on the line.

The UHF Transmitter

This simple 6J6 UHF oscillator works quite well as a low power transmitter in the UHF region. Standard video (1V negative sync) is ac coupled to the cathode for cathode modulation. It was the first one I had tried in the UHF band without the use of an antenna. The plate lines were 7.5 cm long. When the length of the plates and wires inside the tube and the length of the capacitor are added to the length of the lines, we have approximately a half-wavelength, which determines the frequency. Wave phenomenon are noticeable, providing the lines act as transmission lines. In the dark a pencil draws little sparks at each end of the lines and pulls the frequency down considerably, indicating voltage maximums. The center, however, can be touched with a screwdriver and frequency doesn't change, indicating a voltage null. The rf chokes are tapped here. Of course amateur radio license allows TV transmission in the 450 MHz band, and 11.5 cm lines are used then.

The circuit is actually a push-pull tuned plate oscillator, whose feedback is plate to grid capacitance.

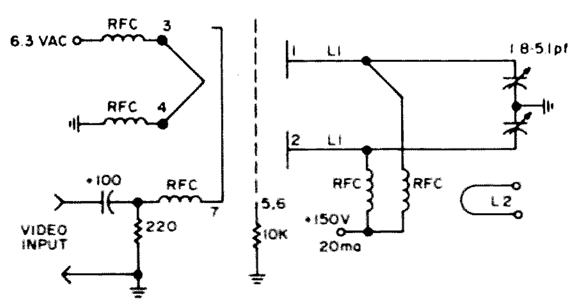


Fig. 10. A UHF oscillator that can be used as a low power transmitter. The video signal can be obtained from the circuit in Fig. 6. RFC-15T No. 24, 3mm diam. Channel 20, L1 – 7.5cm, No. 14 brass, spaced 16mm, tap at 25mm from tube. 435 MHz, 11.5cm No. 14 brass spaced 20mm, tap at 38mm from tube. L2–5cm No. 16, near L1.

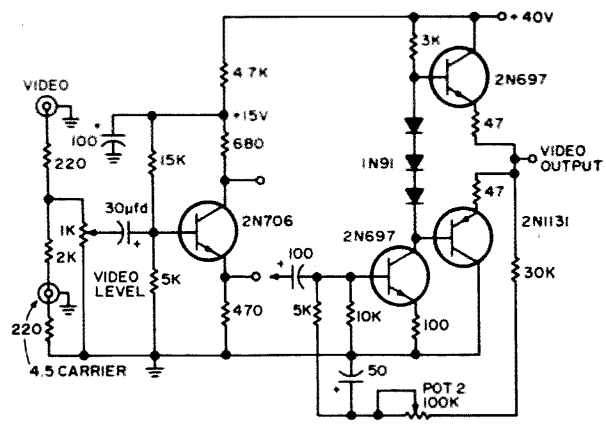


Fig. 11. A video modulator for driving higher power transmitters. It can be driven by the circuits in Figs. 6 and 7.

High Power Modulator

For modulating the grid or cathode of a high power oscillator, a larger voltage swing and a lower output impedance is necessary. The circuit shown here can develop a 35V swing, and is also a convenient place to mix the audio carrier with the video. The transistors are chosen for high gain, high voltage, and high frequency response. The phase inverter was used so that both grid and cathode modulation could be tried, because grid modulation requires positive going sync, and cathode modulation requires negative sync. The emitter follower pair is biased properly for rather small idle current and no crossover distortion, by diodes, and is used for the low impedance output. The potentiometer Pot 2 is adjusted to make the voltage at the output terminal 20V. Audio is mixed with the video at the input so that the video to audio ratio is constant.

. . . .WA7NMO

NI-CAD LIFESAVER

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Give your batteries a chance to say "Ouch".

With the influx of QRP battery operated rigs into the list of station equipment, batteries, particularly nickel-cadmium, are becoming ever popular as the power source. Ever since Motorola made their reject and surplus portable transceivers available to hams, and Drake, Standard and many others came out with portable 2m FM gear, more and more ni-cads have found their way into the hands of amateurs.

Many circuits for charging these batteries are available, including the newer "rapid charge" types, so there is no need to dwell on this topic. The problem many have encountered is when to stop talking and put the battery in the charger. Nickel-cadmium cells, unlike zinc-carbon and other types of batteries, do not show a steady decline in voltage as they are used, but rather a relatively constant voltage until the bitter end when they are just about completely discharged. If they are discharged further *permanent* damage will result. This can be very expensive – expecially in the case of the rapid-charge batteries used in Motorola equipment. It seems that some sort of battery voltage monitor is in order. The size restrictions imposed by the ultra miniaturization of the portable rigs preclude any meter that is available, and besides a meter would not act as a suitable warning device. What is needed is a definite alarm which tells the user "It's time to shut up, NOW." After some thought on the subject, the following solution was tried and found to be highly successful.

The Signetics NE555 chip was intended for use primarily as a timer and oscillator used in conjunction with TTL logic, but I have found its performance leaving something to be desired in these applications; however it does contain two very sharp comparators and a power stage as well as a flip-flop which seems to fill the bill for the battery monitor very nicely. Since the chip contains just about everything needed, only a few external components are required to sense the battery voltage with a resolution better than .2V. When coupled to an indicator of some sort, the whole unit takes up little enough space to be placed inside a rig as densely packed as an HT100.

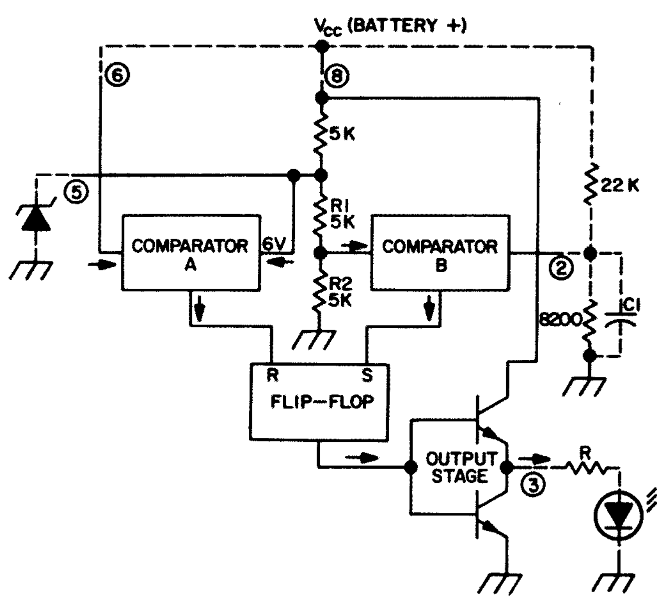

Fig. 1. Functional block diagram of the Signetics NE555 used as a voltage monitor. (External parts shown in phantom.)

A functional diagram of the device, shown in Fig. 1, shows the two comparators, a flip-flop and a power stage. One input of each comparator is tied to a reference voltage generated by the zener diode. The zener holds this voltage constant at 6V for comparator A, and 3V for comparator B (the internal 5000Ω resistors divide the six volts in half). Another 5000Ω internal resistor provides bias for the zener allowing

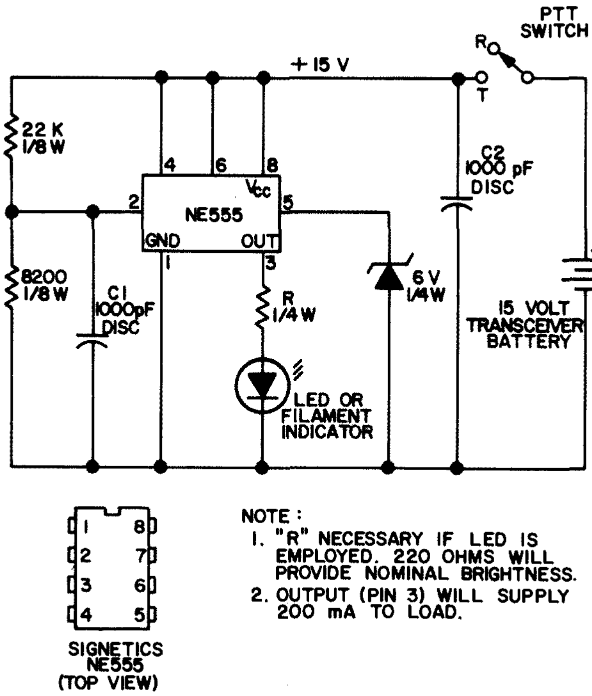

Fig. 2. The schematic of the voltage monitor.

between one and two mA to flow through the zener. The input to comparator A is connected to the battery voltage keeping its output high and resetting the flip-flop. As long as the input to comparator B is higher than 3V, both flip-flop inputs are high, and the output at pin 3 is low (ground). When the battery voltage drops below the threshold set by R1 and R2 (12V, in this case), comparator B output goes to ground setting the flip-flop and causing the output at pin 3 to go high. This output stage consists of two transistors in a totem pole configuration so that the device can supply high current as well as sinking current to ground. One of these transistors (only one) will be conducting at all times, and the chip is capable of supplying or sinking up to 200 mA. In this case it was found convenient to supply current to a load.

Almost any sort of indicator may be used; I found one of the tiny LEDs available from Industrial Devices to be very satisfactory. These are available in either red or green and are small enough to fit in the most compact rig. I mounted mine in the front cover of my HT220 just above the speaker grill so that it is just at eye level when transmitting. There is no current limiting within the NE555, so an external series resistor is necessary if an LED is employed. If a filament type lamp is used this is not required. A small buzzer or even another NE555 used as an oscillator could be powered by the unit if space permits and an audible alarm is desired. The point at which the lamp will light is determined by the voltage applied to pin 2. This can be set by a fixed external divider (as shown on the schematic) or by a pot. I found that fixed resistors were more stable. The values given are for a 15V battery and will cause the warning light to go on when the voltage reaches about 12V. If a different battery is used, set the firing point to about 3/4 of the fully charged voltage. Capacitor C1 is required for an rf bypass and to prevent internal oscillation. C2 is another rf bypass; a larger value might be required for lower frequency operation on 10m or below.

The static current drain (light off) is about 12 mA. Since the battery voltage will show the biggest drop during transmit periods, the monitor should be connected across the transmit supply only (so as not to drain the battery during receive operation).

If room permits, a small PC board could be used, but in my rig there was precious little room available, and the entire assembly was mounted over the i-f amplifier IC in the HT220 slimline. The circuit was constructed by soldering the zener diode and the resistors between the pins of the NE555 chip. The LED was mounted over the speaker and the speaker ground was used for grounding the cathode of the LED. A drop of silicon rubber was used to secure the LED to the front. A note of caution – many LEDs have their anode connection as the outside case so that insulating will be necessary if a metal panel is used.

In use the battery monitor lets you know when your battery is getting close to requiring a charge too. Ni-cads will recover somewhat from a long, high current drain and after a minute or two of steady talking the light may come on to let you know it's time to let the battery rest for awhile. As the battery gets weaker this period of time decreases. When the light comes on almost immediately after pushing the PTT button it's time for the charger.

. . .K2ETN

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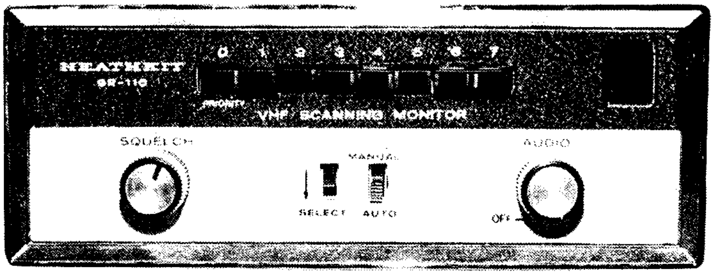
HEATH GR-110 VHF SCANNING MONITOR



One of the popular fads these days is monitoring the radio transmissions of the local fuzz, fire companies and ambulance services. In fact, the local official parties concerned have no difficulty locating the scene of the crime, fire or accident. . .there is usually a crowd of "monitor freaks" which have beaten them to the event. The scanning type receiver is most often seen, as the chance of missing any excitement is eliminated. Most monitors around seem to be primarily brands available at the friendly neighborhood CB equipment store. One of these receivers had been on my want list for quite some time but, as I already had a shack full of gear and needed another receiver as much as the Senate Watergate Committe needed another witness, especially a non-ham band receiver, it was far down on the list. However, as usually happens, a Heathkit ad caught my eye because being offered was a unit with a frequency range that would enable me to monitor the local FM repeater gang (146.94) in addition to the police in my area (155.79) and at a price that is considerably less than other comparable units.

The Heath GR-110 circuits are comprised of 29 transistors, 8 ICs, 17 diodes and a 7 segment indicator tube. The unit operates either from a 120V power source via a conventional transformer-rectifier-filter arrangement or directly from a 12V battery in a mobile installation. The receiver front end consists of two rf stages and a mixer, all of which are 40673 field effect transistors.

A feature of this monitor receiver is a "priority channel" which, if desired, will automatically take precedence over any other signal that is being received. For this purpose, a separate oscillator circuit, consisting of a 2N5232A and a X29A829, pulses the gating circuits and activates the priority channel crystal. If an rf signal is being detected on that frequency, the resultant voltage completes the gate logic and the receiver is locked on the priority channel as long as a signal is present, after which normal scanning is resumed.

Front panel pushbuttons allow selection or bypassing of any or all channels during the frequency scanning process, or a selector switch may be placed in the "manual" mode to continuously monitor one particular frequency. A "select" switch provides manual stepping to the desired channel or the scanning may be stopped by switching from auto to manual while the receiver is locked on a transmitted signal.

Assembly of the kit is facilitated by the use of three separate etched circuit boards and the usual Heath check-by-step assembly manual, which has improved over the years from a "Connect a 680 ohm resistor from N5 (S) to N7 (NS)" step on one page and an illustration on another page, to a combined step-with-arrow pictorial format that is easier to follow. However, after builidng Heathkits for twenty years, I've noticed that the usual paper bag full of resistors, capaci-

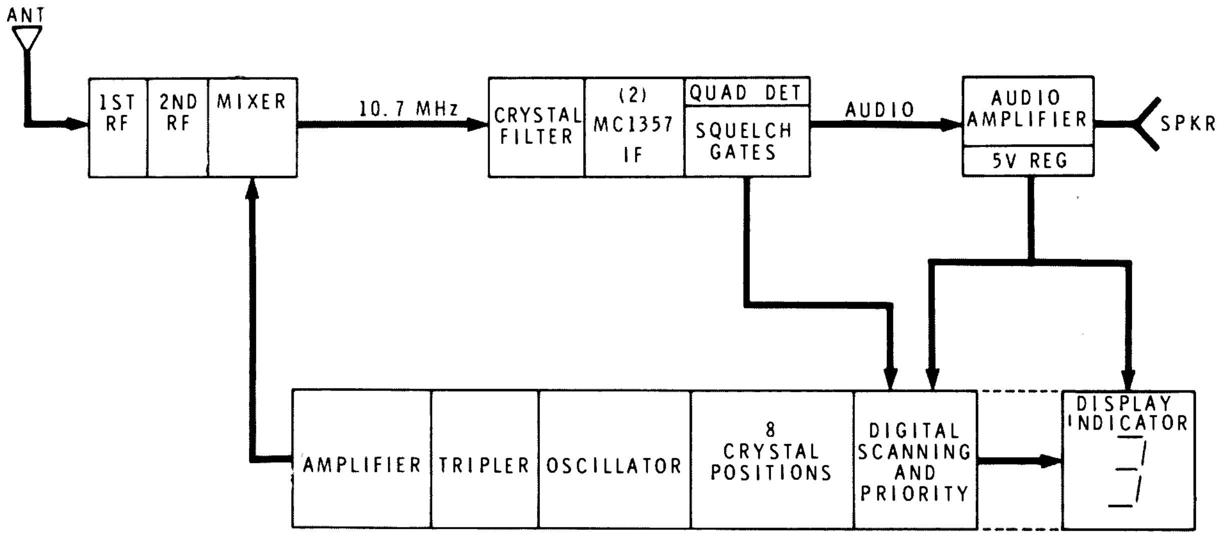
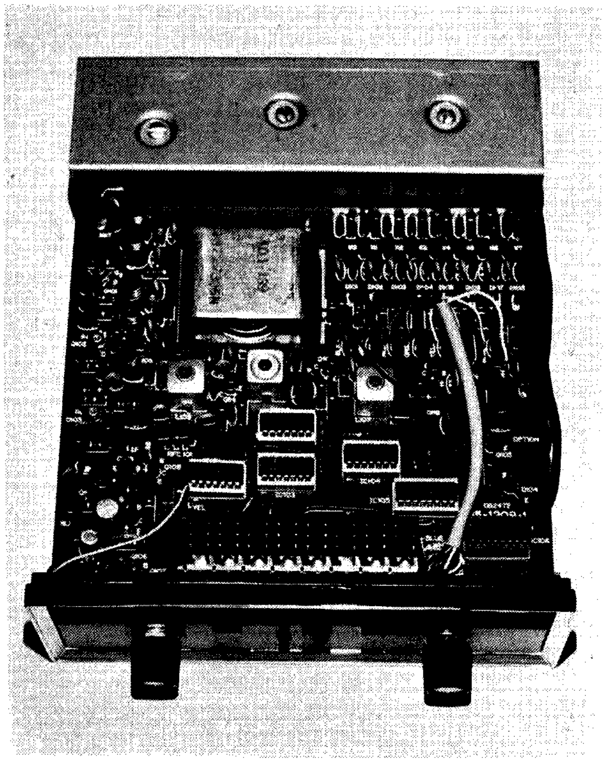


Fig. 1. Block diagram of the Heath GR-110 Scanning monitor.

tors, transistors and such has progressed (?) to a system wherein the bag and its contents are assigned a multitude of pack numbers, index numbers, Heath part numbers and the manufacturers part number. This may assist in some manner with Heath's inventory control or kit packaging process, but I personally feel that the inexperienced kit builder has enough problems without such numerical profusion.



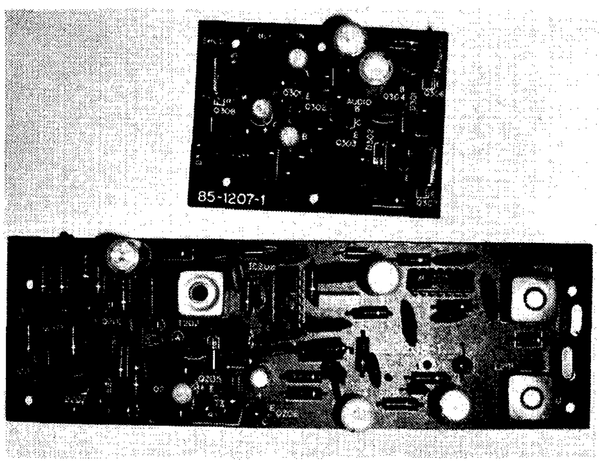
The main circuit board contains the receiver front end (along left side), crystal oscillator circuitry (top right and center) and scanning circuitry (ICs at bottom).

The GR-110 is called a four-evening project. But, if you are a newcomer in the kit building world or are a Theodore Thumbs type, I recommend taking all the time that you personally require for a properly assembled unit. Good soldering techniques are a must. In fact, because I was trained in NASA methods of soldering, I went so far as to clean each circuit board foil pad and individual component lead prior to soldering, and cleaned the residual flux from the completed boards with alcohol upon completion. Also, I recommend the use of heat sinks on each transistor and diode lead while soldering. Alligator clips are fine.

Before the completed receiver can be aligned, at least one and preferably two, crystals must be installed. Crystals are *not* included with the kit, for obvious reasons. Heath does provide crystal certificates, at $4.95 each, which should be ordered at the same time as the kit, and upon receipt, filled out with your desired local frequency and mailed immediately, directly to the crystal manufacturer. Hopefully, the arrival of a crystal and the finish date of the kit will be concurrent. Also, your local parts supplier more than likely has a supply of the more popular frequency crystals for your area in stock.

Alignment may be accomplished with or without instruments. The instrument method requires the use of an FM signal generator capable of covering the desired frequencies and a VTVM. If these instru-

ments are not available, the monitor can be aligned with a simple one-transistor crystal oscillator signal generator kit that is furnished. This generator is very basically an up-converter and is a boot-strap operation in that it obtains its power from the receiver via an alligator clip, obtains an rf signal from the receiver l.o. tripler buffer with another clip, mixes this rf with its own 10.7 MHz oscillator output and feeds the resultant rf signal into the monitor's antenna jack. Using this method of alignment, with a high frequency and a low frequency pair of crystals installed for the desired scanning range of the receiver, was found to be entirely adequate for the type of reception normally expected.



The audio (top) and i-f section (bottom) occupy seperate pc boards.

Since completion, my GR-110 has been almost continually on, and it is somewhat satisfying knowing that I am not missing a thing that is happening around town.

Two modifications have been made to my unit already. First was the removal of the phono type antenna input jack and installation of a BNC type, which is more compatible with ham shack environs. Next, because I have on several occasions forgotten to turn off the squelched receiver prior to hitting the sack and consequently have been awakened by voices in the night, I installed a pilot light on the front panel.

Priced at $119.95, Heath's GR-110 Scanning Monitor is a worthwhile addition to any ham shack. . .and will cause you to wonder how you got along without one.

. . .W3WTO

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AUTOPATCH INTERCONNECTION THE LEGAL WAY

Keep Ma Bell happy.

If you are presently operating an autopatch system or are planning to put an autopatch system on the air, it is felt this information will be of interest to you.

Voice communications equipment provided by you, the amateur and telephone company customer, may be electrically connected to the facilities of the telephone company system *only* through a voice connecting arrangement that is furnished, installed and maintained by the telephone company. This is described in state and interstate tariff regulations. In some states it is a criminal offense to make a direct connection to telephone company lines.

Today the equipment is available for just about any type of interconnection you might have need for. The big problem is communicating your needs to the telephone company marketing personnel. Most telephone company marketing personnel are not technically minded and do not understand what you, the customer and subscriber, might have in mind.

It is felt that the interconnecting devices described here are the best suited for autopatch operation. Which one you choose is determined by your particular needs. The C2A system is now being used with very satisfactory results and this information seems worth passing on.

These devices are known as Voice Connecting Arrangements C2A and SU6AQ. Technical references covering these arrangements are available from the American Telephone and Telegraph Company[1] as a guide for designers, manufacturers, and consultants of customer provided systems and

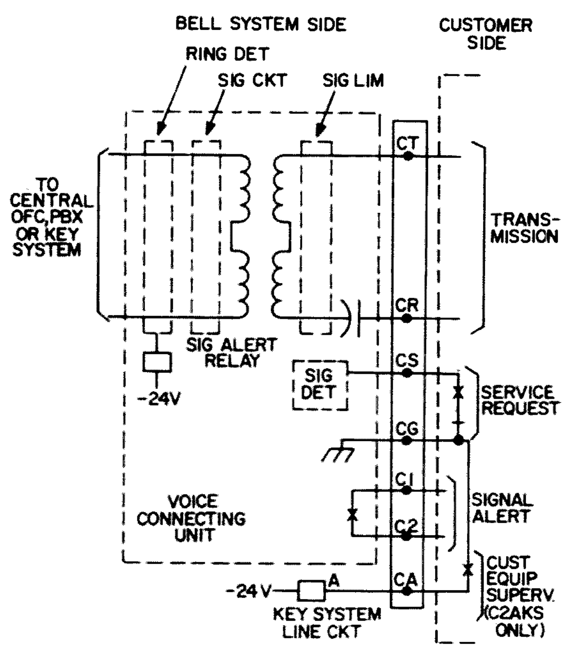

Fig. 1. Simplified schematic, voice connecting arrangements C2ACP and C2AKS.

equipment which connects with Bell System communication systems.

Voice connecting arrangement C2A provides a bridged connection to a line terminated at a telephone company telephone set, typically for use with customer provided call extending equipment. The unit is an 8 in. printed board installed by the telephone company in a 23 in. relay rack or cabinet mounting. A 24V dc power supply is required and is provided by the telephone company. A non-switched, grounded, ac outlet providing 117V ac ±12V, 60 Hz, fused at 15A must be available at the installation location. The temperature range of the unit is 0° to 55° C, with a humidity range of 5 to 95%.

The voice connecting arrangement C2A provides at the interface connecting block the following leads with associated functions for the customer's use:

CT Two way voice transmssion
CR and tone signaling
CS Service request, answer/disconnect,
CG and dc dialing pulses
C1 Incoming ring
C2 signaling

The CT-CR leads provide a two-way audio patch between the telephone line and the customer's equipment. Duplex operation may be used. This includes any TOUCH TONE® signaling. This circuit is a nominal 600Ω and may be balanced or unbalanced. The insertion loss is 1 dB, 300 to 3000 Hz. There are several specifications for this circuit including maximum power level in dBm, audio frequency limitations and when used tone signaling levels and frequencies.

The CS-CG leads are normally open. A short of no more than 18Ω provides a means of answering an incoming call, and initiating a call. Dc dialing pulses are also transmitted over these leads. Further specifications include voltage and current on leads and dial pulse rate.

The C1-C2 leads provide a contact closure during the ring cycle of an incoming call. The closure is opened during the silent interval and is normally open. The load on these leads may not exceed 250 mA non-inductive.

Voice connecting arrangement SU6AQ and STS provides a means for automatically connecting customer provided equipment, capable of orginating and/or receiving calls, such as alarm systems, to the telephone network. An associated telephone company provided telephone set may be used to

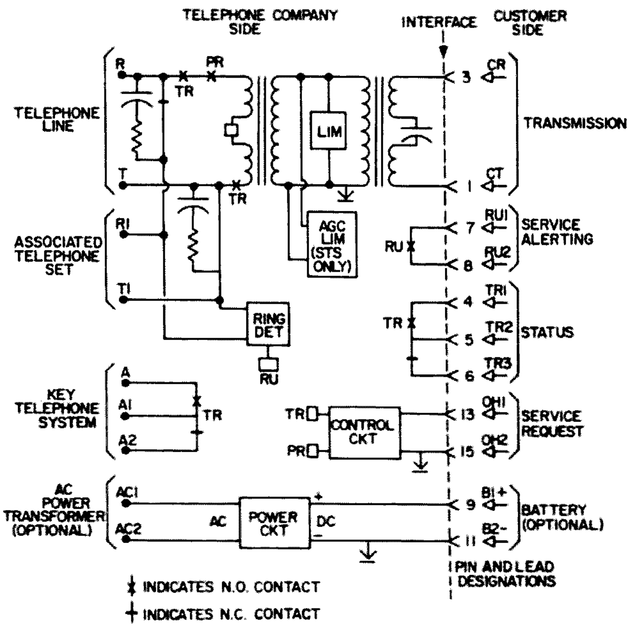

Fig. 2. Simplified schematic, voice connecting arrangements SU6AQ and STS.

provide normal telephone service. Arrangement STS has all features of the SU6AQ and, in addition, permits the customer provided equipment to transmit answer back tones to the distant party through an agc system which assures compliance with network protection criteria (audio level).

The arrangements consist of a printed circuit board housed in an apparatus box approximately 9 in. square and 3 in. deep, intended for wall or shelf mounting. Connection to customer provided equipment is made by means of a 15 pin female receptacle provided at the bottom of the arrangements. The customer must provide the mating plug (Cinch No.231-15-61-133 with hood No.239 -13-99-069). These arrangements will operate from a customer provided battery (18V @ 150–500 MaH) or from a 177V ac, 60 Hz, current regulated transformer supplied by the telephone company. For emergency power the battery may be floated across leads B1+ and B2-. A charging current of 2.5 mA is available while the unit is being operated on ac.

The voice connecting arrangements SU6AQ and STS provide on the customer provided cable leads the following:

CR Two way voice transmission
CT and tone signaling
RU1 Incoming ring
RU2 signaling
TR1
TR2 Status
TR3
B1+
B2- Battery

The CT-CR leads provide a two way audio path between the telephone line and the customer provided equipment. This includes TOUCH TONE® signaling. In addition, with arrangement STS these leads may be used to transmit and receive supervisory tones from the distant party. The insertion loss is 3 dB at 250 Hz and 1 dB over 300 to 3000 Hz. No voice signal amplification is provided. For design purposes the impedance should be considered to be 600Ω. There are several specifications for this circuit, including maximum power level in dBm, audio frequency limitations and when used tone signaling levels and frequencies. The agc limiter incorporated in the transmission path of arrangement STS is to protect the telephone network from application of abnormally high tone signals. It has no effect on normal speech levels.

Leads TR1-TR2-TR3 provide isolated

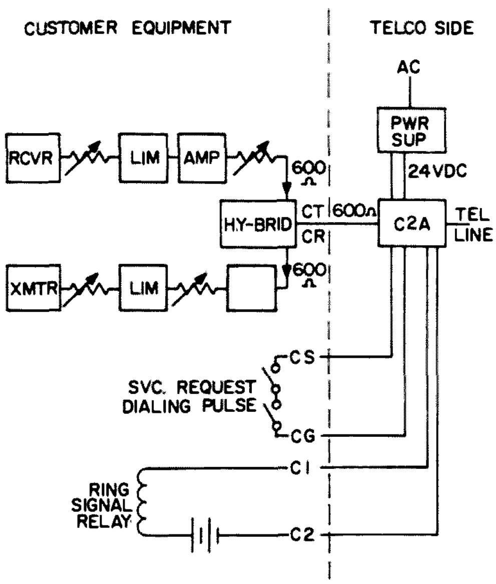

Fig. 3. Typical autopatch arrangement.

contacts to the customer provided equipment to indicate the status of the connecting arrangement. During line seizure, leads TR1-TR2 are shorted and leads TR2-TR3 are open. When disconnected from the line, leads TR1-TR2 are open and leads TR2-TR3 are shorted.

Leads B1+ and B2- provide for a connection to a customer provided dc power source for operating the arrangements. The telephone company may, at the customer's option, provide a power source for the connecting arrangement. The customer must specify which power source is to be used.

Arrangements SU6AQ and STS are normally isolated from ground and therefore customer provided signaling and power supply connections must be isolated from ground. No mention is made about grounding for arrangement C2A except that it is expected that the customer provided equipment will be grounded.

There are several additional specifications which you may need to know if you decide to use one of these units. The intent of this article is to provide information about what is available for interconnection between the telephone network and an autopatch so the amateur will have an idea what type of equipment to ask for to perform the functions desired.

There are several other Voice Connecting Arrangements available, each intended for a specific purpose and available only on certain types of lines. A Technical Reference Catalog which lists all arrangements, respective publication number, and a brief resume on each, is available from the American Telephone and Telegraph Company[1]

The cost of the mentioned arrangements is about $7 per month (varies with the area) and is well worth the investment, mainly – no more worry about what the telephone repairman might find if he unexpectedly visited your shack or transmitter location.

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Publication #40000, Technical Reference Catalog (free). Publication #42207, Arrangement C2A ($1.50 ea.). Publication #42210, Arrangement SU6AQ/STS ($1.50 ea.). Available from: American Telephone and Telegraph Co., Supervisor Information Distribution Center, 195 Broadway, Room 208, New York NY 10007.

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FREQUENCY APERTURE MODULATION

Phase II

Being a radio amateur for over forty years has been a pleasure and I have seen many developments in the art. Much of my operating has been on the phone frequencies and my first love was AM on the old 80 meter band. AM is gradually disappearing and one rarely hears an AM station on the low frequencies. SSB has made a big hit as it permits voice communication in a much smaller segment of frequencies. It is ideal in this respect, but to an old AM lover it still doesn't seem to be best. FM is terrific but here again we end up taking twice as much space in the spectrum for voice transmission. Let's keep trying for a better system! My attempt is FAM or Frequency Aperture Modulation described below.

Before going directly into FAM it is most important to understand FM. A pure unmodulated carrier can be considered as having no bandwidth in the radio spectrum, yet it can be detected. Knowing that it is there, we can turn it on and off with a key and transmit code. This causes the radio frequency to evidence some bandwidth. If a receiver is very selective one can isolate the frequency quite well and receive the code. One way of looking at a carrier in the radio spectrum is the same as looking at the edge of a disc spinning in space. In Fig. 1a the disc looks like a very fine line. It is very difficult to see, like Saturn's ring when viewed edgewise. If we cause disc to wobble on its axis as in Fig. 1b, we can see it far better. We can compare this with AM Modulation. Now if we were to make the disc not only wobble on its axis but also cause the hub of the axis to move as in Fig. 1c we could say this is FM. (Bw represents band-

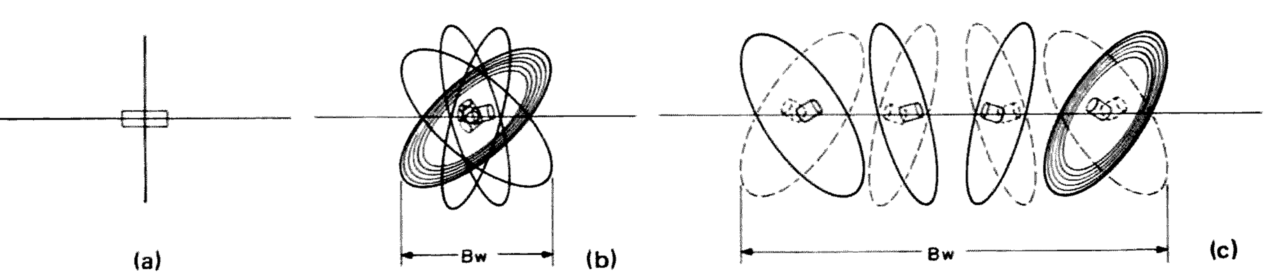

Fig. 1. W2BSP's disc analogy to describe modulation.

width.) Note that the hub of the disc in the case of AM does not move and that in FM it does. This hub can be considered as the fundamental frequency of an oscillator. In AM we try to keep it in one spot of the radio spectrum. In FM we purposely move it and this motion is known as deviation. One of the first arrangements for generating FM was to use a condenser type microphone in an oscillator circuit so that the oscillator frequency was varied at voice frequencies. Deviation is a measurement of how far the frequency, or hub in this case, is moved up and down in frequency. In Fig. 1c, the movement in frequency would correspond to moving the hub from left to right and vice versa. An example would be to use a one cycle per second modulating signal and deviating the hub ±75,000 Hz in the radio spectrum, or a 1,000 Hz signal and deviating the same ±75,000 Hz. In narrow band FM the deviation is small and in FM broadcasting the deviation is very large.

When one frequency modulates a radio wave several things happen. If one modulates an FM broadcast carrier with a 1,000 Hz tone and watches the spectrum that is generated with a receiver that has a 500 Hz selectivity one finds individual radio frequencies every 1,000 Hz. They will vary in strength, but as many as 150 carriers can be detected if the deviation is a full ±75 kHz. All these radio frequencies, commonly called carriers, are generated by the movement of the radio frequencies beating against themselves as the fundamental frequency is swept up and down the radio spectrum. Each audio frequency takes on the same configuration and one finds that when voice or music modulate the carriers a very complex conglomeration of frequencies is generated. If one were to modulate the above mentioned FM broadcast with a 10,000 Hz signal, the total number of individual carriers would be spaced 10 kHz apart and we could detect only 15 individual carriers, assuming that we keep the deviation the same. With these 15 carriers and a system for modulating each, one could make 15 different narrow band FM stations. Stereo broadcasting is done in somewhat the same way.

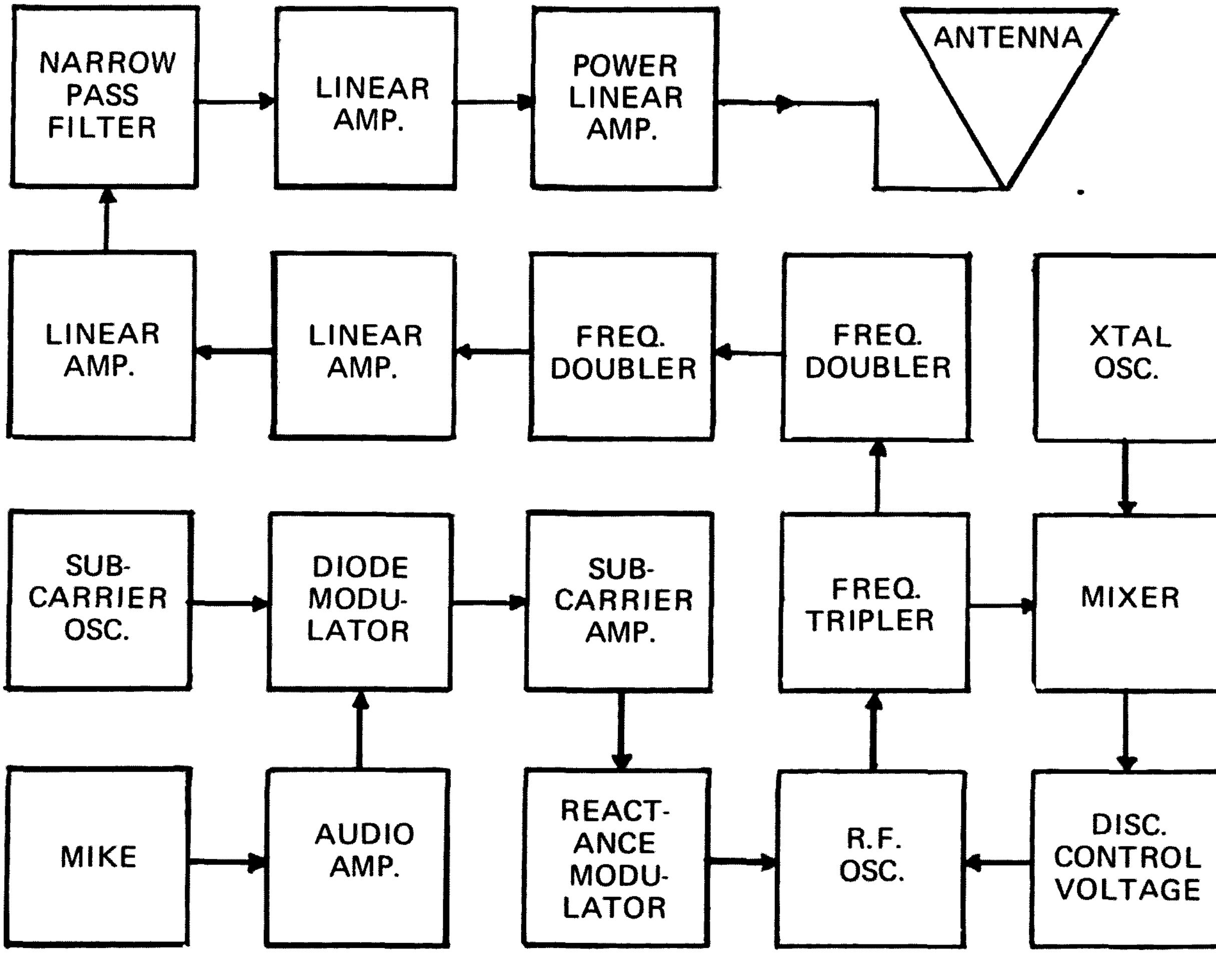

Fig. 2. Frequency Aperture Modulation system.

To move now from FM and into Frequency Aperture Modulation, we know that the normal voice takes about three to four thousand Hz for good understanding. This means that the space in the radio spectrum required for voice will be the same and we have made good radio receivers that can vary a slot or aperture to that extent. Now that we can receive a 3 to 4 kHz signal let us experiment a little. Take two carriers spaced 1,000 Hz apart in the radio spectrum and tune the receiver so that those carriers fall within the receiver's bandwidth. One will detect a beat in the speaker as an audio tone of 1,000 Hz. If one separates the carriers to 3 kHz one gets a 3 kHz tone in the receiver. When one separates the carriers to 5 kHz nothing is heard as the bandwidth of the receiver cannot pass 5 kHz. If the receiver is tuned to one side of a wide-band FM station modulated by 1,000 Hz the effect is similar. If the FM broadcast station is modulated by a 5 kHz tone nothing can be heard. Note that when the FM broadcast station is not modulated no energy ever gets into the receiver because the carrier is off-side. The principle of Frequency Aperture Modulation is derived from this phenomenon.

The object in the FAM system is to generate a frequency modulated spectrum that contains all the voice information in a 3.5 to 4 kHz slot. The generation of a spectrum for FM broadcasting with good linearity requires a frequency modulated low frequency oscillator with its output multiplied till one gets the deviation required. In FM broadcasting large and small deviations are received because the FM receiver has a wide receiving bandwidth. A low amplitude signal that deviates say ±5 kHz is received as well as a high amplitude signal with a ±75 kHz swing and one sees that excellent

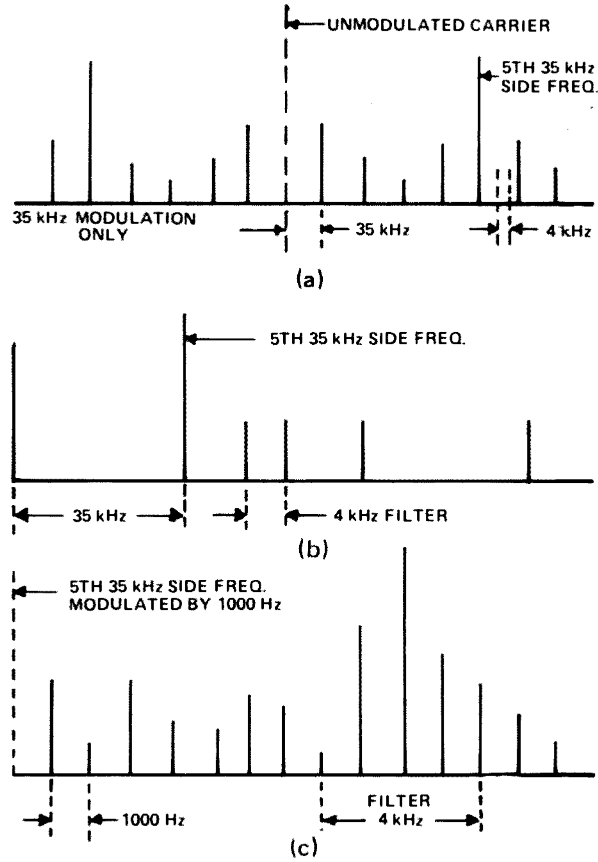

Fig. 3. Spectrum generated by sub-carrier amplitude modulation.

fidelity up to 10 or 15 kHz is possible. If one places the selective receiver to one side of the unmodulated FM broadcast carrier, say about 10 kHz higher, and then deviates the carrier ±5 kHz with a 1,000 Hz audio tone no audio is received: If one increases the deviation more than ±10 kHz the audio tone gets into the receiver. The Bessel-function analysis shows that as we vary the deviation or amplitude of the audio more or less signal will get into the selective receiver. Compressing the audio so that its amplitude varies less, and keeping the level constant, will help in getting more of the signal into the narrow band receiver. Clipping of the audio will also contribute to keeping the deviation constant.

Experiments show that the above mentioned control of the deviation by compression and clipping is insufficient to get fair quality signals in a narrow frequency range and it was decided to add a sub-carrier to the modulation. The sub-carrier amplitude modulated makes a spectrum that can be adjusted like a fine control. Most any

frequency above the audio range and not too high in frequency will work. A frequency of 35 kHz was chosen because available parts on hand dictated this frequency. The spectrum generated is shown in Fig. 3a, b and c. The doubling, tripling, and final stages when tuned to the upper side frequencies peaked at the upper 5th side frequency. This meant that frequencies 175 kHz away from the unmodulated carrier were amplified and used. The amplitude of the 35 kHz was adjusted so that it peaked at the 5th upper side frequency. To facilitate the tests two high Q resonant cavities made of two 55 gallon drums were constructed and were made to tune in the 30 MHz amateur band. They were hooked in tandem to give a band pass of less than 35 kHz. Considerable rejection of the unwanted frequencies was obtained and it was also discovered that some ac hum modulation was giving erroneous readings. The filter was adjusted so that its aperture was between the 5th and 6th upper side 35 kHz sub-carrier frequencies as shown in Fig. 3a, 3b and 3c. All the equipment before the filter operated at low level and shielding minimized spurious radiations. A power amplifier using three stages at the filter frequency was used to amplify the output and it was possible to get about ten to fifteen watts into a dummy load. A very good modulation of voice frequencies was monitored some distance from the dummy load using a long coax line as an attenuator. Accuracy of measurements was limited due to lack of additional test equipment but the results were very convincing. With a few refinements of the equipment an excellent FAM system can be built.

Here is a system that suppresses the carrier and has all the capabilities of SSB. The interference between stations is minimal, as one is able to understand the two stations the same as two people talking at the same time even when slightly off frequency with each other. The output of the filter can be heterodyned with an oscillator making lower frequency operation possible. No on-the-air tests have been conducted due to the fact that the FCC has not yet given its approval.

. . .W2BSP

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VERSATILE TEST EQUIPMENT RANGE EXTENDER

A simple, relatively inexpensive IC amplifier provides accurate and stable voltage gains of either 10 or 100. It can be used to easily extend the sensitivity range of various dc and ac test instruments with a simple scale change factor.

Many amateurs use relatively simple test instruments, such as inexpensive voltmeters, oscilloscopes, etc., for routine maintenance work and construction projects. Simple instruments properly used can suffice for a wide variety of projects. However, there occurs those situations where more sensitive test instruments are needed to take proper measurements. For instance, take the case of those VOMs with a 10V maximum deflection on the low range and a 10,000 (or less) Ω/V sensitivity. Such an instrument is difficult to use when dealing with the low bias voltages on many transistor stages. This is because of the difficulty in reading low voltages on the scale and because of the loading effect caused by the instrument's low equivalent resistance on the 10V range.

A similar situation might exist with an inexpensive oscilloscope where the input impedance is high enough but the deflection sensitivity is low. Rather than buy more expensive test instruments, the "expensive" features of which are only occasionally needed, or do a poor measurement job with the instruments available, it is very worthwhile to use an outboard amplifier, which can both extend the low range on an instrument and provide a very high input impedance.

This article describes such a simple instrument amplifier. There is certainly nothing new about dc meter amplifiers as such. However, the advent of IC operational amplifiers makes the construction of such a device particularly simple. Also, the IC amplifier is internally temperature-compensated, so its gain, once calibrated, will remain very stable under a variety of operating conditions – a very necessary quality if accurate instrument readings are to be obtained. Although some specific integrated circuits are mentioned, almost any operational amplifier can be used. The bandwidth and input impedance will vary with different amplifiers but these factors can be determined from a data sheet.

Figure 1 shows how the outboard amplifier functions when used with a simple VOM. It is placed between the test leads and the terminals on the VOM or other

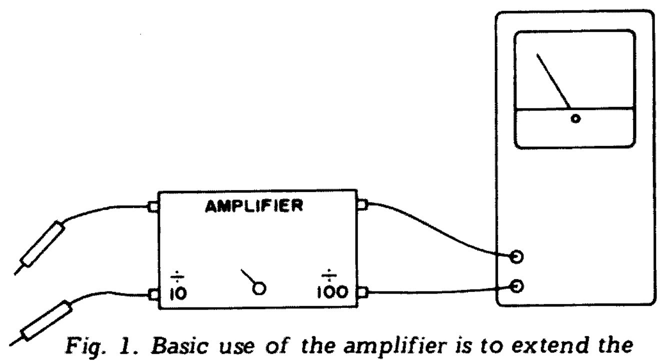

Fig. 1. Basic use of the amplifier is to extend the low voltage (ac or dc) range of a VOM. It also can provide a high input impedance to prevent loading of the circuit being tested.

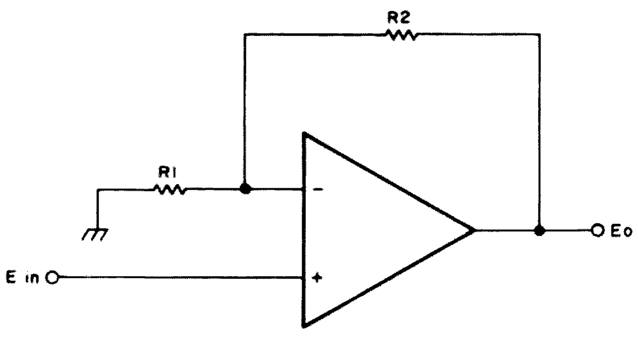

Fig. 2. Basic operational amplifier performance equations.

instrument. It can be used on *either* the ac or dc low range of the instrument. If the normal low range on the VOM is 10V, it will be changed to 1V when the amplifier switch is in the ÷100 position. A similar scale change will occur for any other low range on an instrument (e.g. 5V to 0.5 or .05V). The frequency response of almost any operational amplifier will match that of the usual VOM on its ac ranges where the response only extends to 20 kHz or so. However, if the amplifier is to be used with an oscilloscope or VTVM where the frequency response might extend to 1 MHz or more, an operational amplifier with corresponding bandwidth must be used.

Amplifier Circuit

The basic operational amplifier circuit is shown in Fig. 2. As shown in the figure, the gain of the amplifier (from dc up to the cutoff frequency of a specific amplifier) is determined by the ratio of the resistances. Therefore, by choosing and switching the resistors properly, one can produce an amplifier with specific gains for instrument reading expansion. Bypass and rolloff capacitors may be necessary for a specific amplifier to prevent spurious oscillations and to shape the frequency response.

Figure 3 shows a practical circuit using a Motorola MC1520 amplifier. The frequency response of this unit is quite broad – extending from dc up to 10 MHz. The circuit, however, is typical of that which can be used with other less-expensive operational amplifiers where such a high frequency response is not required. The input impedance is in the order of several megohms and the maximum input voltage that the unit can linearly amplify is ±3V. The amplifier

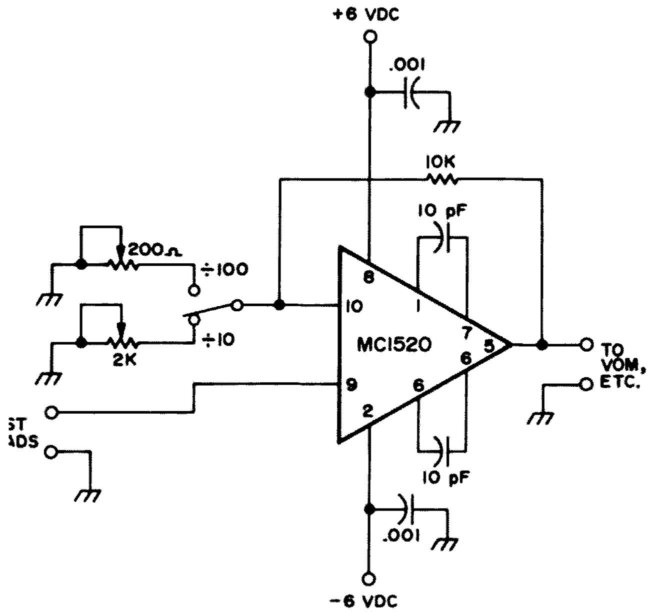

Fig. 3. The Motorola MC1520 general purpose operational amplifier can be utilized for extended measurements from dc to 10 MHz.

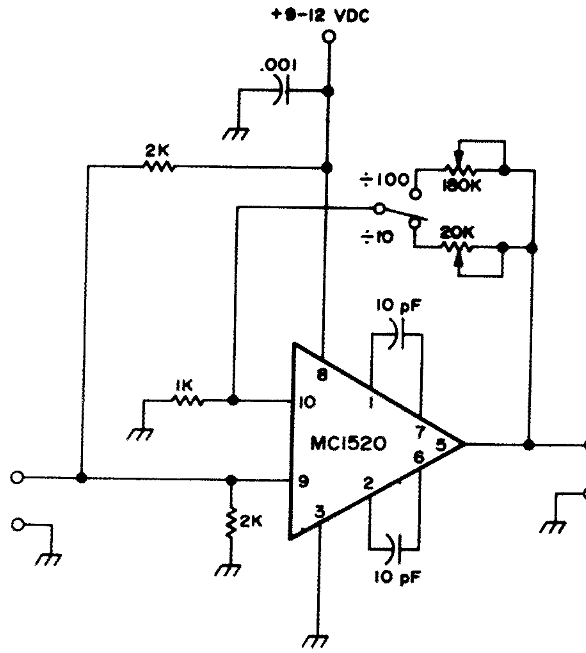

Fig. 4. One can rearrange the circuit of Fig. 3 so only a single battery is needed but the necessary bias arrangement reduces the input impedance.

action is noninverting. That is, positive-going inputs cause a positive-going output, and negative-going inputs cause a negative-going output. So, when measuring a voltage one has to reverse the test lead connections in a conventional manner, depending upon the polarity of the voltage being measured. Two 6V batteries are needed to power the amplifier (a maximum 10 mA current requirement). The absolute maximum supply voltage which can be used is 9V.

Although the current drain is such that small transistor batteries can be used, one may want to use only a single battery. This can be done using the bias arrangement shown in Fig. 4. The amplifier operation remains the same as before but the necessary placement of a bias resistor from terminal 9 to ground considerably lowers the input impedance of the amplifier.

Another amplifier circuit is shown in Fig. 5. The frequency response extends to

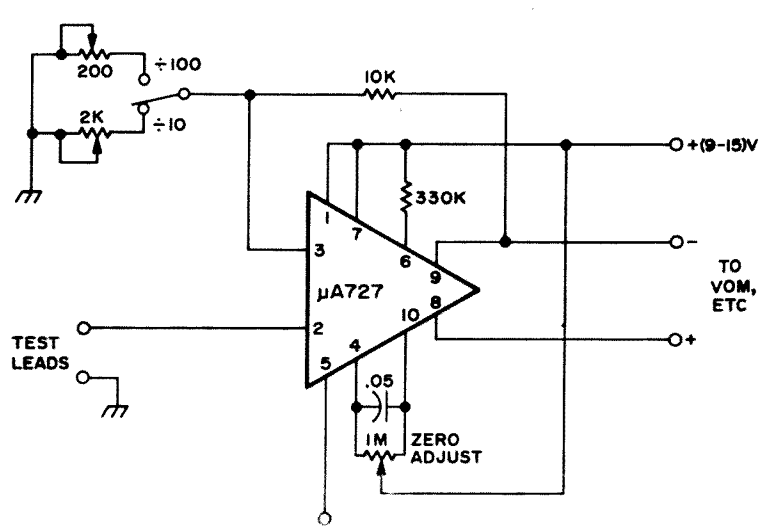

Fig. 5. Another example of the use of an operational amplifier for use as a calibrated gain amplifier. Input impedance for the unit used is an extremely high 1000 MΩ.

only a few hundred kilohertz. A unique feature of the unit is the extremely high input impedance (1000 MΩ) which is better than that provided by many FET voltmeters. The maximum input voltage range is ±10V. A dual battery supply must be used as indicated. Because of the internal characteristics of the amplifier, a separate zero-adjust potentiometer is needed. With the input test leads shorted together, the potentiometer is adjusted for a zero voltage indication on the VOM or other instrument with which the amplifier is being used.

Construction and Calibration

The amplifier can be easily constructed in a minibox or a plastic case. A shielded enclosure, however, is preferable if the amplifier will be used for ac measurements above a few hundred kilohertz. Otherwise, there are no special precautions to be observed in the construction of the amplifier. Naturally, lead dress should be carefully done on amplifiers used in the megahertz range. The calibration potentiometers need be only small, inexpensive PC board types (Mallory MTC) since they only have to be adjusted once for calibration purposes. The zero-set potentiometer shown in the circuit of Fig. 5 should be a panel control.

The calibrating potentiometers can be set by using a fresh battery as a calibrating source with a voltage divider network across it to produce the appropriate voltages. For instance, if 0.1V and 1V were required, a 1.5V battery could be used. For 1V, a divider of 1 kΩ in series with 2 kΩ could be used with the voltage measured across the 2 kΩ resistor. A low-voltage battery should be used (rather than a 9V battery) to obtain 0.1V in order to avoid errors due to divider resistance tolerances.

If an amplifier circuit with a low input impedance is used, such as that of Fig. 4, a divider resistance, across which the calibration voltage is read, should be used which has a resistance of not more than 10% of the input impedance.

The amplifiers of Figs. 3, 4, and 5 have a flat response from dc up to the cutoff frequencies cited and so dc calibration suffices for ac measurements also. This will generally be the case where the rolloff capacitors used are those specified by the manufacturer. If data for the capacitors is not available, it may be necessary to calibrate the amplifier for accurate ac measurements by using an audio or rf generator having a calibrated output.

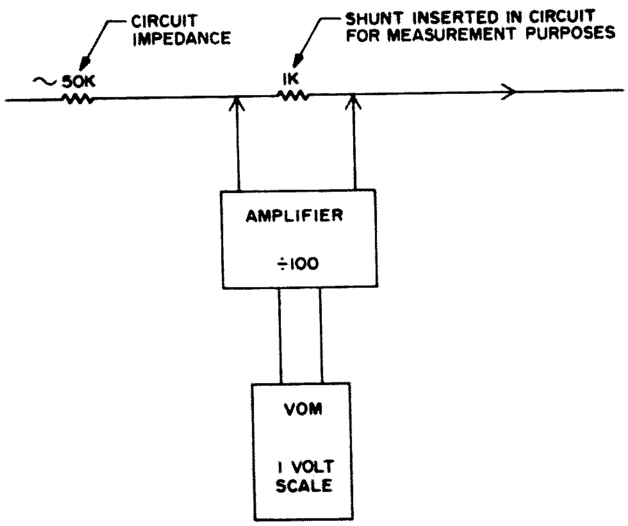

Fig. 6. Another use for the amplifier is to allow very low current measurements in high impedance circuits with simple instruments. In this case 1V scale on VOM is converted to a 10 μA range.

Other Uses

The amplifier unit can be used for a variety of purposes besides that of increasing the sensitivity of an instrument for ac and dc voltage measurements. A simple extension of its use is for the measurement of extremely small currents in high-impedance circuits. For instance, a VOM may not be able to measure directly a current in the low microampere range. By inserting a shunt resistance in the circuit and measuring the voltage across it with the aid of the amplifier, as shown in Fig. 6, one can turn the 1V scale on the VOM into a 10 μA scale. The amplifier can be used as an aid with an rf probe to increase the sensitivity of measurement. Also, because of its frequency range, it can be used as a general-purpose audio preamplifer, i-f amplifer, etc., for a variety of test and experimental purposes.

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A POWER SUPPLY FOR SMALL FM RIGS

Spend some time home with the family

The chief disadvantage of many small FM rigs is the lack of a built-in ac power supply. The current drain of most low power rigs is fairly low so a simple power supply can be built quite cheaply out of standard parts. This power supply can be used as a base on which to rest the rig while operating using ac power. While this supply cannot power amplifiers, in most areas no amplifiers are needed to work many stations. The batteries can be charged while using this supply so the rig will always be ready for portable use.

Circuit

The circuit used is a bridge rectifier and a series regulator using a 2N3055 transistor. The flag type 2N3055 will dissipate 3½W without a heatsink, while the TO-3 type will dissipate 5W without a heatsink. By keeping the dissipation below these levels heat sinking is not needed. The method used in this supply is to put the resistor R1 in series with the collector of the transistor. Thus the resistor and not the transistor dissipates the power. With an 8Ω resistor the transistor dissipation is about .3W on receive and 1.25W on transmit, permitting cool operation.

The 1000 μF capacitor in conjunction with a transistor beta of about 50 makes an effective filtering of about 50,000 μF. The result is negligible ripple in the millivolt range when the supply is operated at full output.

Construction

The supply is mounted on a piece of perf board in a gray hammertone minibox. The toggle switches and neon pilot lamps are located on one end with the output cable, line cord, and the fuse on the other end. The board is mounted upside down in the box using brass screws and hex nuts.

All parts including the transformer are mounted upon the circuit board. A negative bus of 14-gage wire runs along one side almost the whole length of the board. The layout is similar to the schematic.

The dropping resistor R1 is made from 4-32Ω ½W resistors, although a 6.8 or 8.2Ω

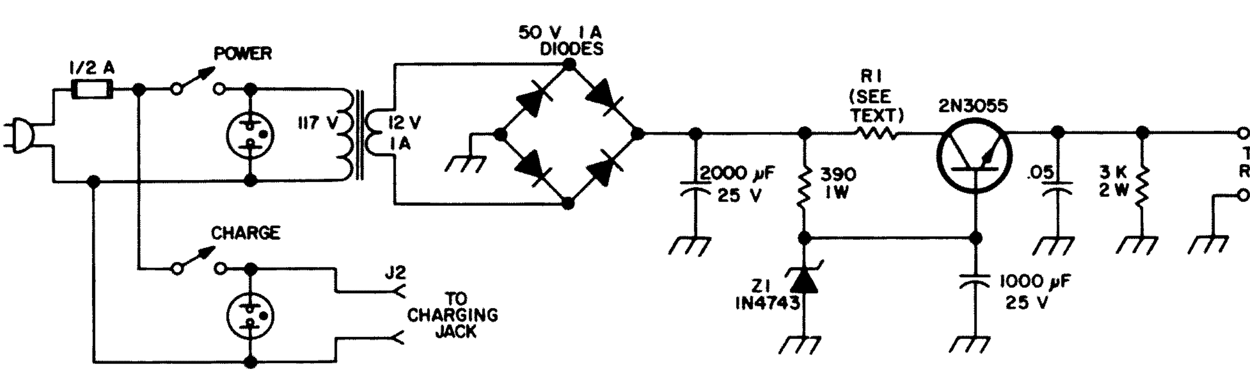
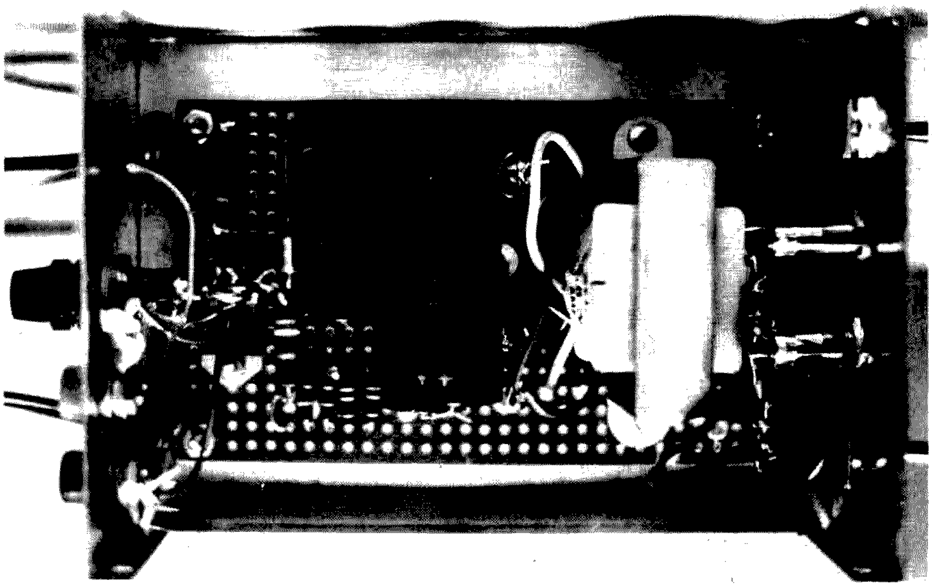


Fig. 1. Power supply schemetic. L1, L2—neon pilot light assemblies. R1—see text. Z1—zener diode—Motorola 1N4743 or Radio Shack.



A view inside the power supply cabinet showing the circuit board.

5W resistor may be used if on hand. For rigs other than the TR22 (the rig with which I was working) the value for R1 may be calculated from the equation

$$R = \frac{Vs - Vout - .7V}{Ixmit}$$

where
Vs = Voltage at capacitor
Vout = Output voltage
Ixmt = Transmit current

For my supply there was 17V in and 12 out so 17-(12+.7)=4.3V. The transmit current is ½A thus an 8Ω resistor can be used. Resistor dissipation is 2W while transistor dissipation on transmit is .5W. The actual resistor value should be slightly less than the one calculated. Note that whatever the case the transistor is operated well within its ratings.

The banana jacks on the rear of the supply are used for testing other circuits with the power supply. A short cable is used to provide power for the TR22.

The cable to the charge jack on the TR22 is made from a TV cheater cord. Because the TR22 has an internal charger with-in, it only needs 110V ac to charge the batteries. If your rig does not have a built-in charger, the cabinet of the supply is large enough to add one.

The only precaution necessary before working on the power supply is to make sure the capacitors are shorted out. Although there is a bleeder, with such high capacitance values the time constant becomes large. Some have said 12V cannot kill. While this may be true I still like to take some safety precautions.

Although a Radio Shack zener was used, a Motorola 1N4743 will provide about 12.3V out instead of the 11.5 I get with the one in the supply. I have noticed no degradation of signal strength or loss of transmitter power due to the low input voltage.

To test the supply do not connect the rig to the output. A friend did this and a shorted transistor drastically shortened the life expectancy of his rig. A 240Ω 2W resistor can simulate the TR22 on receive, while a 24Ω 10W resistor can serve on transmit. It's better to be safe than sorry.

Conclusion

This supply was built in December 1972. It is used to monitor 94 simplex 24 hours a day, seven days a week, in my home in Providence. Even after operating for weeks at a time there has been no failure and no problems of any type. No hum is detected on the audio and the ripple is less than the noise on a laboratory quality meter. The supply can be built for about $15.00 and makes a fine addition to any shack. See you on the air.

...WA3EEC/1

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A RADIATING LOADING COIL

For SWR adjustments in the shack.

How would you like to have an effective 80 meter antenna? If you would, but haven't the sufficient space to put up a "textbook" antenna, you should try this one. The overall length is about 230 cm and it can be located inside your shack or outdoors. It is effective. I've worked many VE3's from St. Louis, Missouri on 80 meters CW with reported signal strengths of 7 and 8 using only 80 watts input to a Heathkit DX605. The cost is less than $5 and it can be constructed in one or two evenings. The swr is less than 1.2 to 1 as indicated by a Heathkit swr indicator HM-15 over the whole portion of the 80 meter CW band (by adjusting taps).

After unsuccessfully trying to load up a random wire antenna on 80 with a low swr and no rf in the shack, I decided I needed seomething else. A review of available antenna manuals, handbooks, etc., convinced me there was no way except to use a half wave wire or a dipole with quarter wave tuned feeders. I simply do not have that much free space at my QTH, not unless I erected a tower in my front and back yard.

I was about to give up ever working 80 meters until I got interested in shortened antennas. Most of these, however, required center (critically adjusted) loading coils or complicated matching devices.

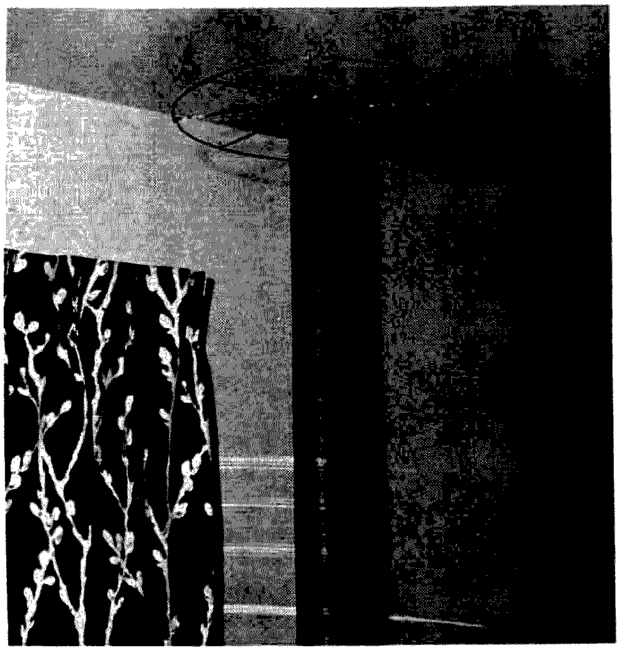
One that appealed to me was the Helix, briefly described in the ARRL Handbook. It is nothing more than one half wavelength of wire, helical wound on a long coil form and operated as a quarter wave vertical against ground and fed with 52Ω coax.

The Handbook showed how an adjustable loading coil could be used to change frequency. My thoughts were, why not consider the whole helix as one continuous linear loading coil, provide taps on it and feed it directly without any external coils, tuners, etc. That's what I did, and it worked.

Once you select the band you want to build for (you should be able to build a Helix for any band) you should consider where it will be located – indoors or out. If indoors, naturally it won't have to be quite as rugged and should be small enough to move conveniently. You could use almost any material for the form – plastic, paper tubes, wood dowels, etc., as long as it suits your needs and is considered low-loss at the rf frequencies you will be using.

I used cardboard (paper) mailing tubes as they were readily available at the local stationery store. Most tubes of this type have telescoping lids. Both the tube and the slip-off lid had formed-in metal end caps. Try to use this type of tube if possible, as they are easier to work with. The diameter can be anywhere from about 4–7.5 cm and the selection should be based on the band the antenna you are making will cover. Naturally, forms for 75 or 80 meters should be of a larger diameter than a 40 meter one to avoid crowding the turns. Obtain as many tubes as needed to make up the length of form you want. If you use those with metal ends, remove them with a small saw. Either use the "necked down" end of one tube to slip into the other tube or use a separate piece of smaller diameter tube to fasten them together. Use Duco cement, Elmer's Glue or any other good cement to join the tubes. Do a good job as it's difficult to reglue them after they are wound.

Whatever type of form or forms you used, you should end up with one long form 200–250 cm long and about 7.5 cm diame-



This particular model almost reaches the ceiling of the shack. A wire capacity hat was added to increase the effective height and bring more rf current up the coil.

ter (for 80 meters) with a metal end at each end only. If open-end tubes are used you will have to add some sort of mounting brackets. The completed tube should be thoroughly saturated with Spar Varnish or a good grade of shellac, inside and out. I poured varnish inside and rolled the tube around while tilting it back and forth before I glued it together. I would advise against using paint as there may be some metallic pigment in it which would affect the Q.

Prior to actual winding, determine the pitch (number of turns per inch) to use in order to uniformly wind the coil to fill the entire length of the tube. Leave a few cm at the bottom for possible additional turns – discussed later. This is easy for those who are excellent at math, but the rest of us will have to use the formula $C = \pi d$, where circumference equals pi (use 3.14) times the diameter of the form. You can calculate the length of wire to use, or look it up in the Handbook. You will need to wind one-half wavelength of wire on the form. Since you know the length of the winding space on your form, this formula will tell you how much wire (in length) will be needed for one turn. Divide this number into the total length of wire (40.84 meters for the 80m band) to see how many turns your coil should have.

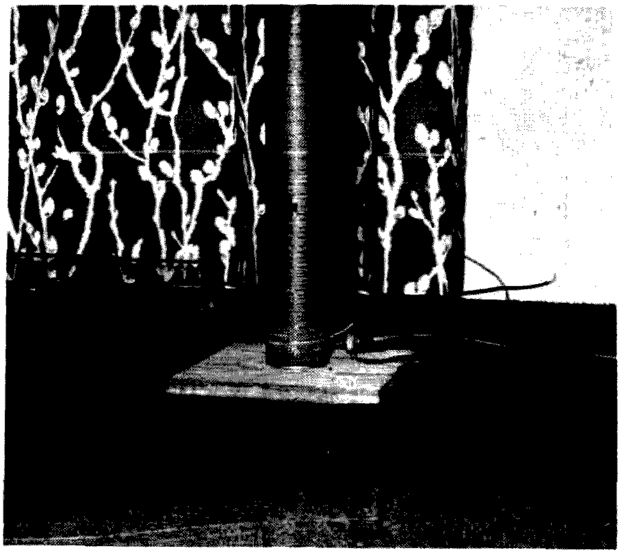
For my 7.5 cm diameter form it came to 174 turns. Since it was 225 cm long, it required 1 turn each 1.3 cm. Use a metric rule and mark the form at 1.3 cm intervals. When you wind be sure that the wire crosses each successive mark. It's all right if the pitch varies a little; it does not have to be perfect. The best way to wind is to have another person slowly rotate the form for you. I used No. 16 AWG solid enamel wire, but any suitable size could be used. It would depend on the power you intend to use and the total number of turns. I suggest that you not use anything smaller than 16 AWG.

When you have wound on about 90% of the wire or about 160 turns, you should tap every second turn from then on. These taps will be at the bottom of the antenna and will allow you to cover the entire band. Wind a few extra turns (about 5 or so, at least) to compensate for any miscalculations. To make the taps, scrape a few cm of the enamel insulation from the wire, (bare wire could be used if available) and twist a loop in it and solder before continuing to wind. After you have completed the winding, it can be terminated by drilling two holes through the form and threading the wire through each.

The completed coil should be given several coats of varnish or other low loss material to hold the turns in place. If you are going to use it outdoors, then additional weather proofing measures are necessary (coat with clear epoxy, etc.).

Mount on a suitable wood or plastic base. A 20 x 20 cm piece of plywood is satisfactory. Either run screws up from the bottom into nuts soldered to the bottom metal end cap or use several small "L" brackets. Mount a female coax connector to this base also with "L" brackets. Solder the free end of the coil to the center conductor of the coax connector along with a short length of flexible wire equipped with an alligator clip for reaching the taps. Mount a binding post on the mounting base and connect it to the coax shield for grounding.

A capactive hat can be a metal disk about 30 cm in diameter or wire radials (No. 10–12 AWG solid wire) about 30 cm long.



The base is a piece of plywood with a coax connector attached for easy disassembly.

Solder the disk to the metal end cap or mount with small "L" brackets and connect to the top of the coil. If you use wire, simply poke them through one side of the form out the other side. Use about 6 or 8 pieces and solder them where they cross at the center. Then form a circle of stiff solid wire around the ends of them and solder to form a complete loop or halo with spikes.

Tune-up is straightforward. Try loading it up with reduced power first at the low end of the band. Use some sort of reflected power or swr indicator and check the loading. Soon you will find which tap to use for the low end of the band; then move up and repeat the procedure. If suitable loading at full power for your rig and low swr cannot be obtained, you may have to add more turns or unwind some from the bottom and add more taps.

As this antenna is used as a quarter wave vertical, it must be operated against ground. I used a single 200 cm ground rod driven in the ground outside the window of my shack and used a length of copper braid to the ground terminal on the antenna.

I imagine that an antenna of this type would work very well outside with a set of full size radials. I also imagine that a 20 or 40 meter antenna would work equally well. Using similar construction techniques a multiboard antenna form could be assembled in a few hours.

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PEAK / NOTCH IC AUDIO FILTER

Operational amplifiers such as the 709 and 741 have made it possible for the amateur builder to construct CW audio filters that have excellent characteristics. However, typically, these operational amplifiers require a dual power supply, i.e., ±9V. most amateur equipment is designed to operate from a single power supply, +12 for example. Motorola has recently offered a "monolithic quad single supply operational amplifier," the MC3401P. Detailed specifications are described in their Bulletin No. DS 9191. It is essentially 4 internally compensated operational amplifiers in a single 14 pin TO-116 package. The power supply is + only; +5 to +25V.

Motorola's Bulletin describes several possible uses for this chip. The unit that I

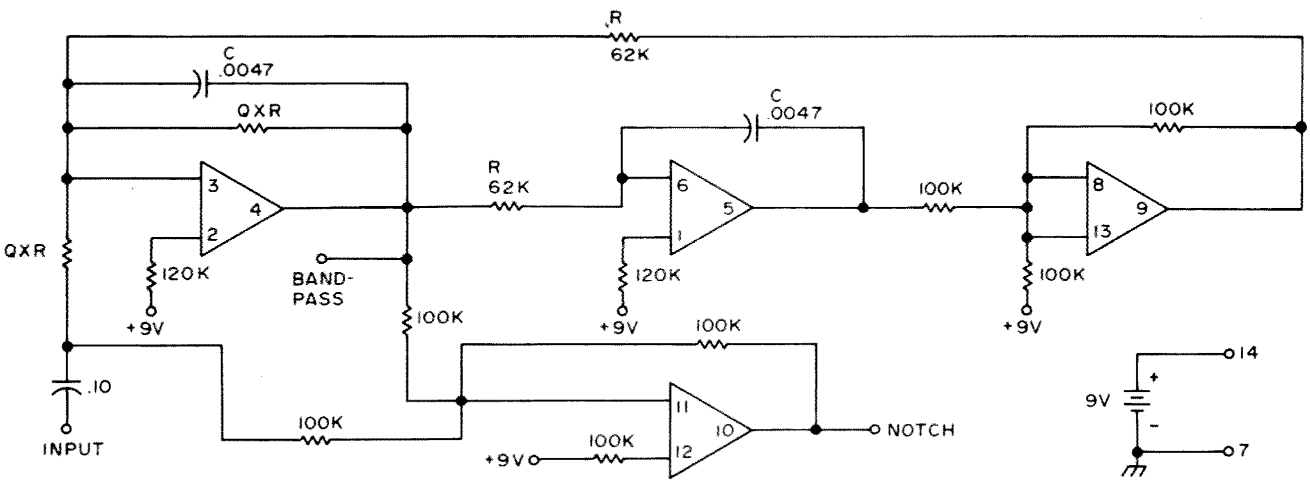

Fig. 1. Schematic of the peak/notch audio filter using the MC3401P.

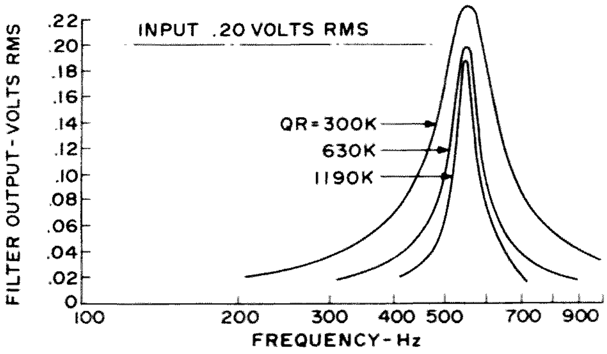

Fig. 2. Measured characteristics of the bandpass filter using different values at QxR.

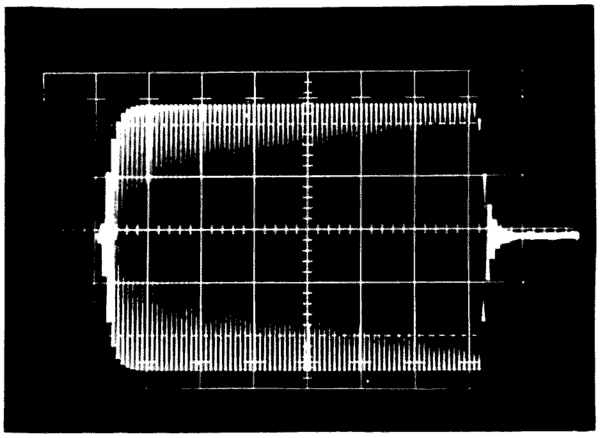

Fig. 3. Keyed waveform, QxR = 300K. Horiz. = 20 msec/cm.

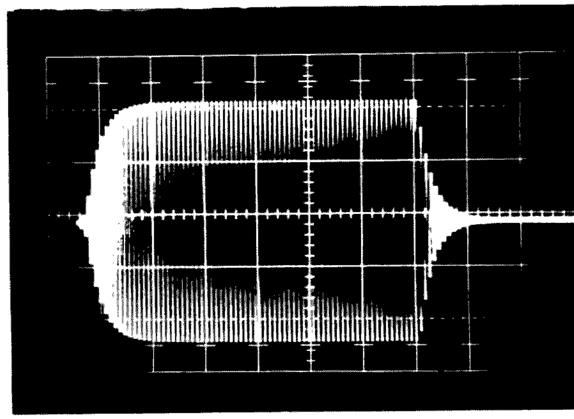

Fig. 4. Keyed waveform, QxR = 630K. Horiz. = 20 msec/cm.

constructed is a peak and/or notched CW audio filter. The single supply makes it particularly attractive to amateurs with receivers using only one supply.

Fig. 1, shows the schematic diagram of the filter. The center frequency of the bandpass or band reject is determined by R and C.

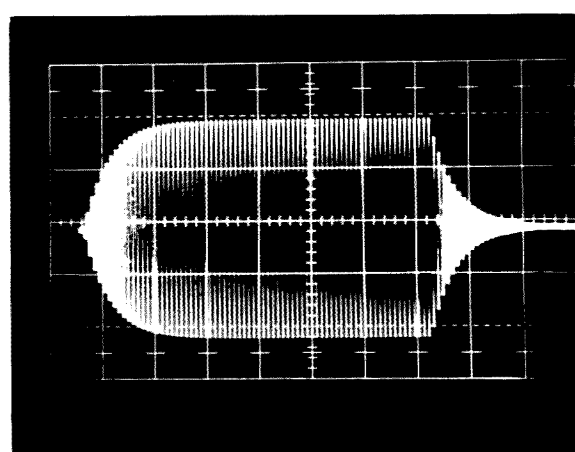

Fig. 5. Keyed waveform, QxR = 1190K. Horiz. = 20 msec/cm.

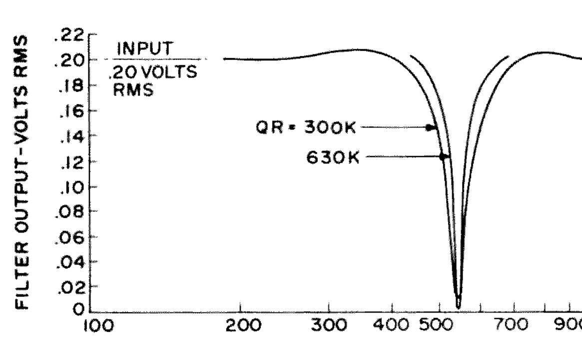

Fig. 6. Measured characteristics of the notch filter using different values at QxR.

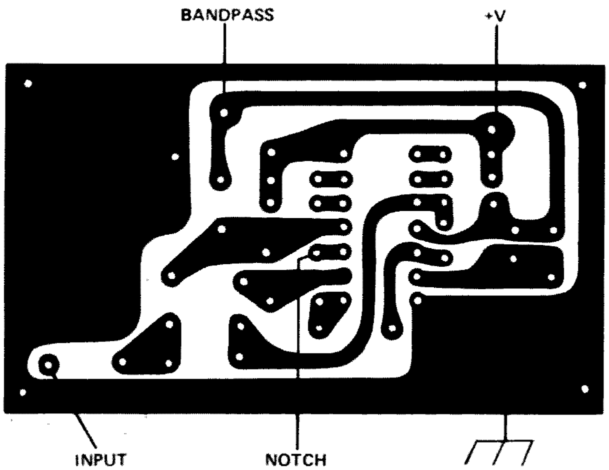

Fig. 7. Full size pc board layout (foil side) for the peak/notch filter.

For the unit shown R = 62K and C = .0047 μF which yields a center frequency of 540 Hz. The actual unit peaked/notched at 545 Hz. The measured performance of the peaking filter is shown in Fig. 2. The variations in bandwidth are achieved by varying the two resistors marked QxR. If these two resistors were grouped together, one could achieve variable bandwidth with only one central knob. The gain of the circuit is nearly unity but it can be varied as described in the Motorola Bulletin.

The 6 db bandwidth of the sharpest filter tested was 66 Hz. Figures 3, 4 and 5 show the keyed waveform of the three bandwidths shown in Fig. 2. The keyed waveform is clean and sharp with rise and fall times determined by the filter bandwidth.

The notch characterisitcs of this filter are shown in Fig. 6. The gain of the filter outside the notch area is close to unity. A single pole double throw switch can be used to switch from bandpass to band reject, depending on the nature of the received signal. For example, bandpass would be best for CW while band reject could eliminate an undesired CW signal near a single side band signal without destroying the information content of the SSB signal.

Fig. 7, gives a full size template, foil side, for a printed circuit board. The price of the MC3401P operational amplifier is near a dollar, truly a bargain for such impressive performance.

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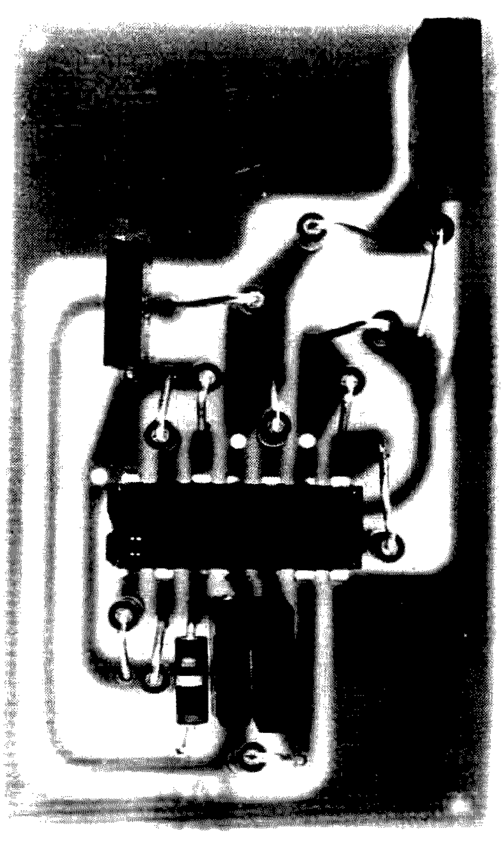

The input capacitor is at the top right in this photo.

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POWER FAILURE PROTECTION

Protect your QTH from the Energy Crisis!

Power interruptions in heavily-loaded and densely-populated areas are seldom simple on-off phenomena. In many residential areas if the power goes off for more than a few seconds it may take hours to restore complete service, even though the initial cause of the outage is corrected promptly. Because of the dependency of our modern culture on electrical power, extended outages can paralyze large areas, stopping everything from traffic lights to electric can-openers.

This extension of simple outages is brought about by the non-linearity of many electrical devices. Their starting current is many times greater than their running current. Many motors, for example, have starting currents from three to ten times their full-load running current. Lamps, similarly, and nonlinear having a cold resistance of from one fifth to one tenth their hot resistance.

In consequence of these characteristically heavy starting currents, if the power fails in a heavily-loaded area perhaps due to systemic overload, restoration of the power is likely to impose an immediate load several times greater than it was at the moment of interruption. This is likely to precipitate another outage beginning a vicious cycle which can only be broken by sectionalizing the loads at the power house or at some convenient substation. Such repeated outages have occurred several times during the past few years in a number of our larger cities.

Remedial measures

When the power fails for any reason a recurrence of the failure on restoration of the power can be prevented if all power users turn off all heavy loads immediately. When the power has been restored the heavy loads can be turned on again, one by one, without imposing too great a starting load on the system. This simple instruction is much easier to give than to follow.

Automatic shutoffs

Because most power outages occur at odd times when "the man who knows what to do" is at work, out for a beer, or otherwise unavailable, some sort of automatic shutoff

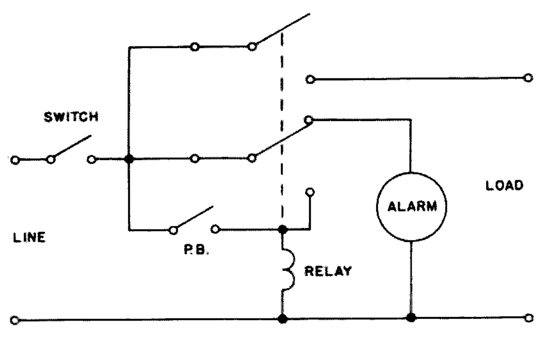

Fig. 1. Circuit of automatic shutoff.

for heavy loads such as deep-freeze, air conditioners, electric ovens, etc., is desirable. Most fortunately, such devices are relatively simple and not too costly, even for loads of up to 25 amperes (or more).

Circuit of one smoothly-working automatic shutoff which effectively disconnects the load from the line whenever the power fails, and which does not reconnect it when the power is restored, is shown in Fig. 1. This is one form of the self-holding relay circuit.

In operation with the power on the load is not connected until the switch is closed, and the push button momentarily depressed. This energizes the relay, connecting the load through the upper armature contact, and connecting the coil to the high side of the line through the lower armature contact. Opening the switch turns the load off.

If the power fails the relay armature releases, disconnecting both the load and the relay coil from the line, and putting the alarm in circuit. This can be anything from a neon lamp to a raucous ac buzzer. When the power is restored the alarm is energized, but the load is not. Depressing the push button momentarily reconnects the load to the line and deactivates the alarm so that the load operates normally until either it is shut off or the power fails again.

Higher power shutoff

Many relatively large lelectrical loads such as building air-conditioners, cannot be started merely by connecting them across the line, but must be run up to speed by use of a control box or Variac. If the power is interrupted while they are running, and then restored, they tend to either pop the breakers, or to run at half speed and high heat eventually damaging the motors. They must be started each time from Variac zero.

Although some of the more modern air-conditioners have an automatic starter which gradually speeds up the motors when the power is applied keeping the current drain from the line within safe limits at all times, many systems now in use do not have this convenience and need protection in event of power failure. Circuit of an automatic disconnect so that the Variac must be returned to zero before the system can be started or restarted, is shown in Fig. 2.

Here we again use a self-holding relay in conjunction with a push button and a Microswitch controlled by a cam on the Variac shaft. When the Variac is set at zero, and only then, the pushbutton is connected to the line so that it can close the relay circuit. Once this is closed it is self-holding and the Variac is energized so that the motor can be run up to speed by the Variac control.

If the power fails, the relay releases, disconnecting itself, the Variac, and any load controlled by it from the line; and connecting the alarm. When the power is restored the alarm is energized, but the load cannot be reenergized until the Variac is set to zero which closes the Microswitch so that the push button is operative. The alarm automatically reminds the operator to either turn off the switch or to complete the starting cycle.

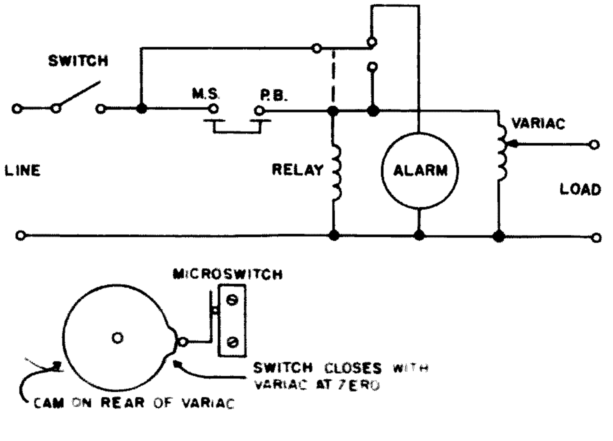

Fig. 2. Automatic disconnect for Variac starters.

Construction and workmanship

Both of the devices here outlined are of a safety, or "insurance", nature. In consequence, they should be built with considerable care using components chosen with an adequate margin of safety. Layout should be chosen for maximum convenience of operation and construction be such that checking and maintenance are easy. Local electrical codes should be followed as closely as possible. If the local code does not cover, "due diligence" will be demonstrated if you follow the National Electrical Code.

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160m ANTENNA COUPLER

Work DX on 160m with a 2 meter beam

"One-Sixty! Aw, come on, man, that's dc. No, I've never tried it. After all, who has a back yard big enough for a dipole that big!"

Doubters, rejoice and take heart. It is possible to give off good vibrations from a teeny wire on top band, if you know how. First, you must overcome the wavelength gap. That is, think positively and accept the fact that an antenna doesn't have to be self-resonant. Seems like we've been brainwashed to the point where antenna means a half wave center-fed dipole. Look at it this way: an antenna wire can be simply one plate in the capacitor of a parallel-tuned circuit. The other plate, as you can probably guess, is earth ground. Add a coil to resonate with the capacitance and you have a radiating system. Figure 1 shows the derivation, step-by-step.

As every Novice knows, the circulating current in a parralel-resonant circuit is maximum at resonance. He also knows that the more rf current in a conductor, the stronger the field around it. Thus, if you build a giant parallel-resonant circuit, say 30m or more in diameter, and pump rf through it, some of the rf will leak off and cause a desirable disturbance in a receiver a surprising distance away. If you tune the circuit to the same frequency as the pump (the transmitter) current and field strength are greatest.

As mentioned earlier, one capacitor plate is earth ground. The other plate is any metallic object spaced and insulated from ground. It can be a coax-fed doublet, a two-meter beam or just about any imaginable aerial adornment you're using on the other bands . . . just be sure it isn't grounded outside the shack somewhere. If you have more than one antenna, you can connect the feed lines together. The more the merrier and the more capacitance to ground. In the case of coax-fed antennas, connect the shield to the center conductor and treat it as one wire.

In order to get rf into our newly discovered antenna circuit, we must solve the problem of matching a low impedance transmitter to a high impedance antenna. This turns out to be no problem at all if we take advantage of the fact that the inductance of the antenna circuit is available in the shack. Although we could wind a low impedance link on the antenna coil, it turns out to be far easier to let the transmitter share part of the antenna inductance, using the principle of the autotransformer. That is, in the same way you can tap off a small voltage from a large voltage, using a resistive voltage divider, you can tap off a small impedance from a large impedance using an inductive impedance divider.

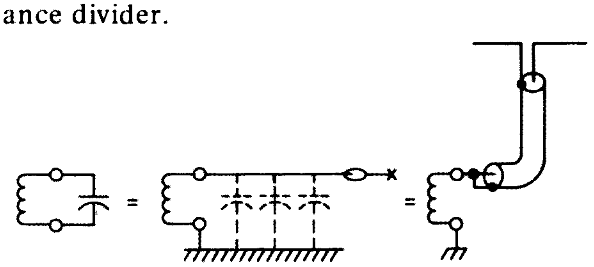

Fig. 1. An antenna is equivalent to a tuned circuit.

Enough theory! Let's get down to the nitty-gritty of practical circuits. And how simple it is! All that's required is one coil, two alligator clips and an rf current indicating device. The latter may be an rf ammeter, say 0–30A or so, or can be a couple

of pilot lamps wired in parallel to share the current.

Figure 2 shows the lash-up. For operation on the 1.8–2.0 MHz band, the winding should be at least 5cm in diameter, about 13 cm long (the bigger the coil, the better) and have about 40 or 50 turns of bare or tinned copper wire. About any old coil will do. If you can't find one in surplus, wind it yourself.

Setting the taps on the coil is largely a matter of cut-and-try. The thing to keep in mind is that the position of the bottom tap controls the coupling between the antenna and the transmitter; the upper tap controls the resonance of the antenna. Although you can do the whole thing by trial and error, having a vswr meter in the coax line between the transmitter and the coil makes life simpler. If you have a grid-dip meter as well, it's a real breeze.

With test equipment, proceed as follows:

1. Connect the bottom of the coil to ground. This can be the plumbing in your house, a ground rod or whatever you use for a normal ground connection.
2. Connect a jumper from the outside plug shell of the coax line of your antenna to the center pin of the plug. Connect the shell to an alligator clip connected to the 30th turn from the bottom of the coil.
3. Couple a grid-dipper, tuned to 1.8 MHz, to the coil. Adjust the top tap by selecting a greater or lesser number of turns with the alligator clip until resonance is achieved.
4. Connect the coax outside braid on the line from your transmitter to the bottom of the coil (ground). Connect the center conductor to the 10th turn of the coil, using an alligator clip.
5. Turn on the transmitter (tuned to a vacant frequency) and adjust the bottom tap and the transmitter loading control for minimum reflected power. Be sure you don't exceed the maximum transmitter power input for your geographical area.
6. Readjust both taps until you have maximum antenna current and minimum reflected power.

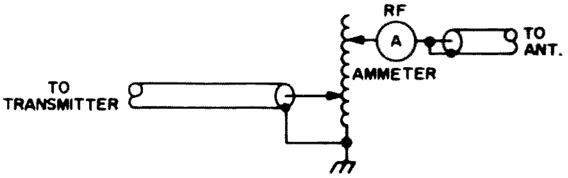

Fig. 2. The tuning system.

With no test equipment, simply adjust both taps and the transmitter loading control until you get maximum antenna current for any particular value of plate current.

High rf voltages are present in the circuit under key-down conditions, even with moderate transmitting power. Therefore, play it safe and do all your adjusting with the key up.

If you are a newcomer to 160, be sure to check the regulations on sub-band frequencies available and the maximum daytime and nighttime input power restrictions that apply to your state.

So, come on in and join the fun. 160 is open to both phone (mostly SSB) and CW. Even the most jaded DX-chaser will get a real kick out of working across the Atlantic when the signals start pouring in on those cold winter nights.

. . .W2LT

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THE HT120: ONE UP ON MOTOROLA

The relationship of the hand units with the silver dollar at the right is one of size comparison only.

Owning the very latest in Handi Talkies had always been the apex of many FMer's ambitions. I myself have looked on, green with envy, as one of my buddies showed me his new six channel five watt HT220; but the price stopped me dead. Well, if you aren't rich, but are the type who likes to be the first on your block with a new goodie, try this on for size: An HT with one watt output (minimum), receiver rated at .3.35μV for 20 db quieting, Private Line, six channels, and even Touchtone, all in a box the size of an overgrown package of cigarettes and costing less than $200! I should have you hooked, so read on.

Recently HT220s seem to be showing up everywhere.

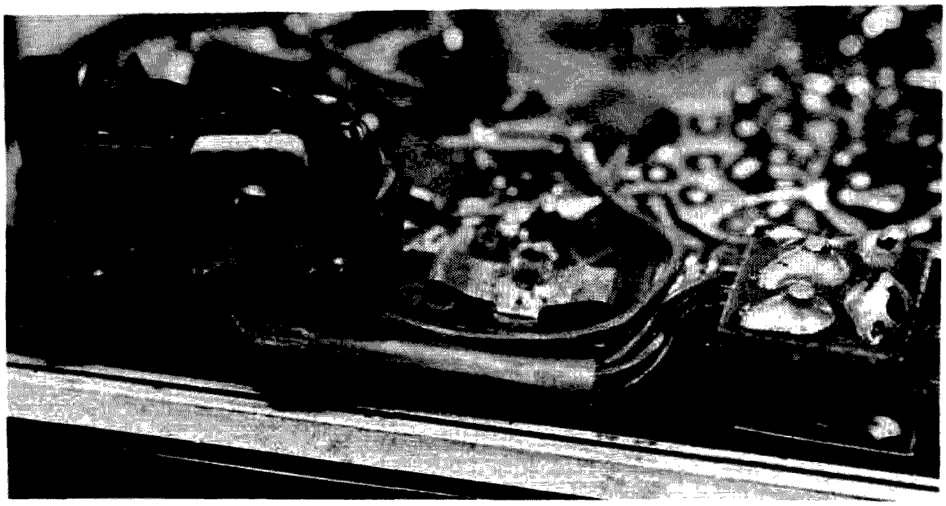
It should be noted that the circuit boards that form the heart of these units are not always perfect, but whatever the problem they can usually be fixed. As an example, the circuit boards are constructed without trimming each component lead individually as it is installed. At the end of the production line a saw is used to trim all the leads simultaneously. Occassionally the saw takes a nip out of the board itself, forcing quality control to reject it. On others, a small wire jumper or component may have been installed on the rear of the board to circumvent a board problem; and although the board may have been removed from a working and tested unit, Motorola, tightening their quality control, will no longer allow these jumpers in units offered for sale.

In these cases the unit is disassembled and Spectronics acquires the completed circuit boards for resale to amateurs. With a complete HT220 board, new case, parts, controls, hardware and the manual, you can come pretty close to rolling your own.

The basic HT220 is a compact single frequency version, rated at 1.8 watts output. Slightly larger housings make available such options as a 5 watt output deck (capable of up to 10 watts), Private Line, two, four or six frequency capability, and even Touchtone; or varying combinations of all of these.

By the time I was aware of all of this, I had already completely remade my HT220, and since the HT220 with all the additions of my HT200 would be close to the same size, I decided to hang on to my HT200 until I could acquire a radio that would represent a significant reduction in size.

Thus, I was quite happy until one night at SAROC in Las Vegas. While I was wandering around, I managed to stumble into a Motorola HT100. That's the little critter about half the size of the HT220, but rated at only 100 milliwatts output. I had once



The upper left corner of this picture shows the stock Motorola PL deck, which slips into the niche in the back of the unit. In the lower right corner is the PL reed plug.

considered the HT100, but thought the power output too low for reliable coverage. As the little gadget was discussed it was plugged into a wattmeter and checked out at 1.8 watts!

Well that took a little explaining. It seems that the HT220 and the HT100 share the same circuit board. The only real difference is that in the HT100 the final output transistor is eliminated and the driver is matched to the antenna for 100 milliwatts output. In addition, a higher impedance speaker is installed to lower the battery drain and a much smaller battery is installed, form fitting the case at the rear of the circuit board rather than below it. In this case the HT220 board had been installed in the HT100 housing and presto, the birth of the HT120 (HT120 is my own personal designation for the unit.), a 1.8 watt HT100.

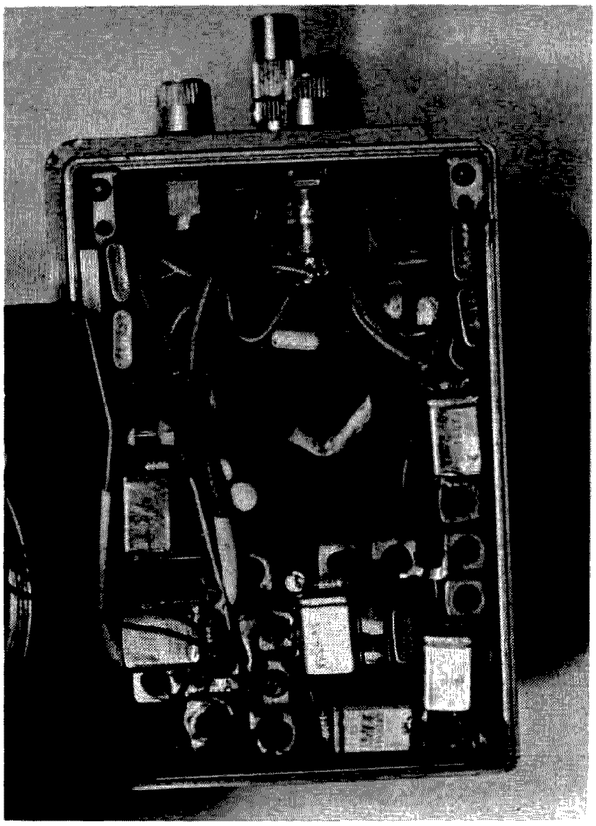
There is of course an obvious fly in the ointment. Motorola portables are designed with an eight hour 5-5-90 duty cycle (5% transmit, 5% receive, and 90% standby). This is Motorola's criteria for choosing the battery size for a particular model. In the case of the standard sized HT220 this requires a 225 mA battery. So considering the HT100 uses a 70 mA battery, the apparent normal duty cycle of the HT120 would be 2½ hours at 1.8 watts. In practice, however, I have found that I have been able to use the unit for more than a full day by carefully choosing my words, not being long winded, and by detuning the radio to one watt output, thus further reducing the battery drain. More about that later.

Well, I had to have one. Of course I needed built in PL and multi-channel capability, but I was sure that I could do that, so I ordered all the parts. I then acquired the manuals for both the HT100 (Motorola part #68P81065A25-A, and the HT200 (Motorola part #68P81059A20-B).

A note on crystal ordering. Don't be too concerned with an improper receiver i-f crystal for the 146-148 MHz range. Different i-f crystals are specified to prevent a harmonic from interfering with the intended receive channel. Although my unit does have the wrong crystal for the 146-148 MHz range (16.8 MHz), I have encountered next to no difficulty. I am currently receiving on 146.61, 146.64, 146.82, 146.94, 147.33 and 147.36. Of all of these frequencies the only one I have encountered any problem with was 147.33, on which I found a slight harmonic carrier a bit off channel; but it was so low in level that it was just barely detectible.

After installing the crystals that I could in their stock locations, I used the exploded view of the unit in the HT100 manual to assemble it. Then referring between the HT100 and the HT220 manuals I connected the various color coded leads to the frequency control switch, volume control, PTT switch and the battery case. I found a parcel of wires that had been connected to the PL board in the HT220 installation; I cut these off as close to the board as possible.

Next it was necessary to remove the spring contactor that joins the coax output to the antenna on the matching case half,



If you take care, all those crystals can be sandwiched into the unit.

since they are in different spots in the HT220 and the HT100. There was one hole in the board in the correct place, and I drilled another to mate with the bottom half of the spring contactor. I then rerouted the coax and connected it to the spring contact, with the shield to ground (the metal case near the frequency switch). Next I connected R40 (the internal squelch control) to it's corresponding wires. After checking the "A" line with a VOM to ground to insure a reasonable chance of having no problems, I connected 14V dc and turned it on for the smoke test. The first good sign was squelch noise.

It took very little tuning to get the receiver to better than it's rated .35mV for 20 db quieting. The transmitter was just as easy. Considering the transmit time necessary for tuning, doing so on the battery could prove harmful. I would recommend a regulated current limited bench supply capable of 14V at 500 mA, such as the Heath IP 27.

The tuneup procedure was very straight forward, and I did not find it necessary to add any padding capacitors to the unit. If you cannot tune to the factory specifications, refer to the manual for the value differences between the "H" capacitors (150.8-174 MHz) and the "L" capacitors (136-150.8 MHz) and add about 60% of the difference to the bottom of the board in the troublesome circuit and retune. I recommend 60% of the difference to optimize tuning in the 145-147 MHz range.

The largest caution in the tuning procedure is the current drain on transmit. I initially tuned my unit up on a bench supply without monitoring current drain. I was able to obtain three watts output, but found later that I was drawing in excess of 500 mA. Here again monitoring the tuneup on a current regulated supply will prevent many problems and save a lot of time. I found that even tuned to the rated 1.8 watts the current could range from 310 mA to about 500 mA.

I then correctly tuned the radio to 1.8 watts and 310 mA current drain, and connected it to the ni-cad battery. The battery proved capable of supplying the load, but it was obvious from the voltage drop that the battery couldn't handle this type of use over the long run. If you find 1.8-2.0 watts essential, the HT120 will reluctantly provide it for short transmit periods. I chose, however, to reduce the output to one watt, and through careful tuning and retuning of L107, 109, 111 and 112, I was able to minimize the current drain to 230mA. This will greatly increase the length of talk time avatlable, and the time between replacement of the battery. Best of all it means that the output of my HT120 is less than 3 db worse than the standard HT220, and yet, 10 db better than the HT100, in the same size package – to me a reasonable compromize.

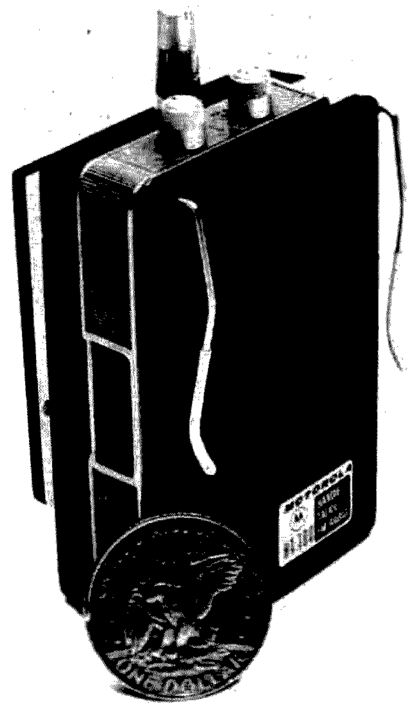
Next I decided to tackle the multi-channel problem. I wanted to try for six channels. The HT220 board makes the job an easy one, since all that is required to add channels is a crystal, a resistor, and a coil. I obtained the six channel switch, and installed it in the "squelch on/off/F1-F2 switch" position. Since my unit was a stock two frequency unit, I wired the first two switch positions to the circuitry already on the board. For the other crystal positions refer to the picture.

I first attached the load resistor directly to the leads of the crystal. I then soldered the crystal to a convenient transformer can to achieve both a mechanical mounting and an electrical ground. You will find many small spaces between the components on the board and the case where chrystals can be placed on their sides and not interfere with assembly of the unit. I must caution you though, to use the most delicate soldering technique you can master. It is extremely easy to break the crystal within the case with even moderate heat. Next, I bent one lead of the crystal around and soldered it directly to it's case. I then attached a teflon wire to the remaining crystal lead and routed it to the coil; the other lead of the coil being connected to the frequency switch. I placed two coils horizontally, one adjacent to the two stock receive crystals and the other cez to the bottom of the unit. The remainder of the coils were placed in whatever holes I could find; primarily near the volume and frequency switch controls.

At this point you might wonder why I mounted the crystals and coils in the manner described and neglected that "chasm" between the frequency switch and the case. Looking again at the pictures you will find that this is where the subminiature reed for the Private Line oscillator mounts. If Private Line is not a necessity on your radio, I would indeed suggest this as an excellent place to mount both crystals and coils. Perhaps I should mention here that crystal lead length appears to be no problem. Several of my crystals are as far as they can get from the oscillator, and I have found no problem with them oscillating or getting them on channel.

To make the job more professional, I removed the stock two frequency escutcheon and took it to my jeweler. He was able to turn the plate over, elongate the holes to accomodate the volume and frequency switch shafts (the holes are slightly off center), and re-engrave it with vol/off, F1 through F6, and my call. Although this cost $7, I thought it worthwhile in ease of use and eye appeal.

As I mentioned earlier I needed PL in my unit. I decided to order the stock unit from

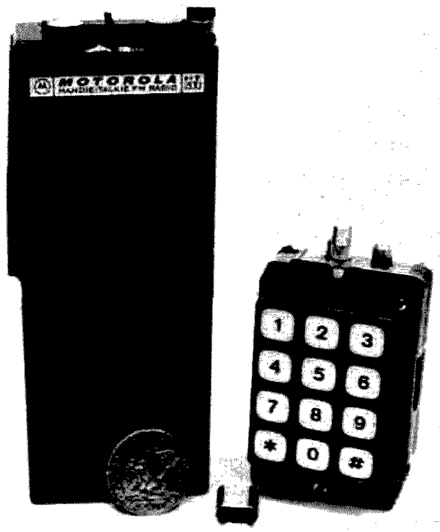


A belt clip fashioned from modified hair curler springs. The springs are epoxied into small holes drilled into the panel.

Motorola. The PL deck (Motorola part NLN 6801A) and the reed (Motorola part TLN 8904A) cost $50, but I wanted the unit as professional as possible. Since I could never locate a picture of the HT100 with the PL deck installed several calls to Motorola gave me enough hints to get the job done.

The PL deck itself fits in one of the two niches in the section of the case that houses the antenna. The main body of the reed fits in that "chasm" I was talking about earlier, next to the frequency switch. The pins project through the circuit board, two of the pins going through holes you must drill. The reed plug mates to the pins of the reed from the non-component side of the board next to the frequency switch. The deck is then wired as per the instructions in the HT100 manual. A very simple connection to the transmit switched 14 VDC, ground and audio out.

This is perhaps the most unusual PL deck and reed that I have encountered. In many PL circuits the reed is under continuous oscillation since it usually takes about one to



A size comparison of the HT100 with the HT200 — big difference!

two seconds for the reed to "come up to speed." This circuit and reed, however, receive no power until you begin transmitting, yet the PL tone is immediately at the full deviation level needed. On a modulation scope I could see no signs of any start up time, the full sine wave was immediately apparent. One other difference from most PL boards is that receive PL is not available. Due to space limitations the PL board provides a tone for transmit only, the receiver is not tone coded. This should be no handicap for repeater use, however.

A final addition to the unit is Touchtone. A year or so ago I developed a technique of adapting a Trim-line Touchtonepad to my HT200 using internal power. I later adapted the same Touchtone pad to my HT120 as a temporary Touchtone device. At the time I realized that I would eventually be using a much smaller device, but I did need tone control immediately. In mating the Touchtone pad with the HT I wanted a semi-permanent mounting that would allow the HT to be held in one hand with the push to talk activated, while the other hand was free to use the buttons on the pad. To accomplish this I mounted the pad in a small LMB box, making both the mechanical and electrical connection to the HT through a subminiature phonejack and plug. The bottom of the pad is stabilized on the HT with small strips of "Velcro." Luckily this technique for Touchtone was temporary, since the pad and box was nearly as big as the talkie itself.

I acquired a very small and reliable Touchtone device manufactured by Waller Electronics in Chevy Chase MD. John Waller currently has in production a device he calls the "Tesco pad." It is available in kit form, wired or as a "sealed Tesco pad" (a sealed compact silver coated unit) for mounting on the HT220, HT100 or almost any other hand unit made. I acquired one of the latter specifically modified so that actuating a microswitch on the side of the pad converts the third vertical row to the forth row using 1633Hz for additional control function. Unlike the Trim-line pad, this unit is more appropriately sized and covers about 65% of the surface area of the back of the HT120.

The pad I chose is the "sealed Tesco pad," which I highly recommend if you are going to use it with a hand unit of any type. One of the primary problems in adapting the new hybrid Touchtone chips, such as this Waller pad uses, to ham use has been radio frequency interference. Of course if your needs are for a pad mounted on a dashboard, or with a base station,use of the standard kit or wired form is great. In a talkie however, the rf is within inches of the chip and RFI can cause the chip to change frequency and output level.

Initial tests with a chip mounted in an HT220 required extensive rf bypassing by trial and error to achieve a reliable tone output. Waller has gotten around this problem by producing a special RFI shielded package designed especially for hand units. The completed unit consists of the switch assembly and a machined piece of aluminum stock that provides mounting room for the integrated circuit, a tone level pot, and a row switching microswitch (optional). In this sealed pad the IC is actually removed from its case to make the package even smaller. After all the components are mounted, wired, and tested, the unit is potted, and then silver coated for rf isolation. No further shielding or isolation should be necessary.

As is the case of the PL board, the installation is very simple. One wire connects

to the transmit switch 14V, one to ground and one to the audio input. The pad comes with four tapped holes and matching hardware for mounting on various talkies. In the HT120 installation only the top two of these screws are used since the pad must be mounted on the rear of the talkie over the battery. To mount the pad this way we must modify the battery so that we can remove it by pulling it straight downward rather than lifting the bottom out as it was originally designed. To accomplish this first remove the clip from the battery, hold down the screw so it can be unscrewed all the way. Secondly, cut off the ridges at the bottom of the antenna slot on the underside of the battery pack that inhibit the battery from being pulled straight down. Once you are sure that you can move the battery in and out without first having to lift the bottom away from the talkie you are ready to mount the pad.

After removing the back from the talkie drill two holes, one in each niche on either side of the antenna slot. These holes are as close as practical to the battery compartment. One additional hole must be drilled to accept the three color coded wires. On my HT120, due to the curvature of the rear of the unit, I had to make two other alterations to make the bottom of the pad fit flush with the battery pack without any bottom pad mounting hardware. First, I used a small shim properly positioned between the two mounting screws to tilt the bottom of the pad towards the talkie so it exerts slight inward pressure against the battery. Secondly, since the case bulges out slightly I marked where the outline of the pad meets the battery, and within those limits, I carefully ground away a tiny pit of plastic by trial and error until I could slip the battery in under the pad with a flush all-around fit.

Now with the hardest part behind, simply connect the three wires as illustrated in the supplied data. Leads should be kept as short as possible, but that is the only precaution necessary. The audio level is easily adjusted through a hole in the side of the pad without having to disassemble anything.

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SSTV - ISB

Transmit video on one sideband and audio on the other.

Independent Sideband (ISB) is authorized to be used by amateur radio stations. This is a method of transmitting and receiving two signals on the same frequency. Regulations permit the transmission of voice on one sideband and video on the other sideband of one carrier frequency.

There is nothing particularly complicated about the generation and demodulation of ISB signals. There are many handbooks published on "sideband." With this information available as a guide it is easy to build equipment to generate and receive ISB or to add equipment to your present transmitter and receiver.

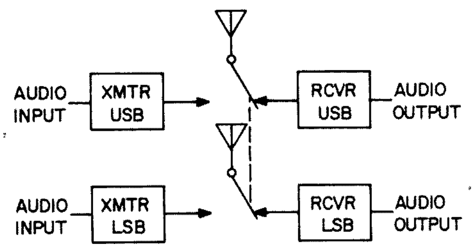

Fig. 1. Independent sideband using two transmitters and two receivers.

One of the easiest methods of transmitting and receiving ISB is to use two single sideband transmitters and two single sideband receivers which are tuned to the same frequency. Several slow scanners, who have the equipment, have used this method to generate and receive ISB. Fig. 1, shows the method where one transmitter and one receiver is tuned to the upper sideband and the other transmitter and receiver is tuned to the lower sideband.

Figures 2 and 3 show the method used at W7FEN's station to generate and receive ISB using a KWS-1 transmitter and a 75A4 receiver. This required a minimum of modification to the transmitter and receiver. The KWS-1 transmitter only required a small wiring change, the addition of a relay and a small switch. The switch was mounted in place of the dial drag knob shaft. A cathode follower was added to the 75A4 receiver on the chassis at the center rear.

The relay switches the transmitting ISB exciter to the 250 kHz injection plug in the

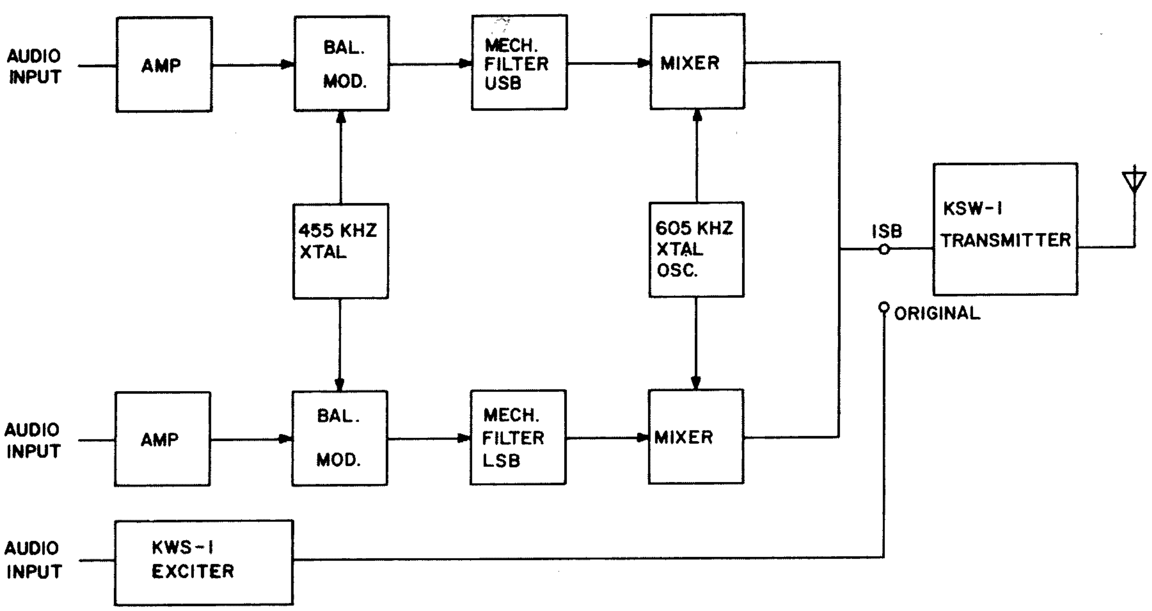

Fig. 2. Addition of ISB adapter to KWS-1 transmitter.

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CLASS B COMPLEMENTARY PAIR

Many of you have encountered the words "complementary pair" and on occasion have come across "complementary-symmetry output stage." Perhaps you shrugged it off with the notion you would return at some later date to learn more about this particular use of transistors. I did return.

The Search

As I searched for practical information regarding this transformerless Class B audio circuit, it became clear that few circuit designers take the time to do more than star (*) those two transistors and add a footnote telling you these ' must be factory matched pairs." The average well adjusted person would accept this and not bother to learn a bit more about why they should be matched pairs. After all, portable radio sets and economy model hi-fi amplifiers use them; they work. Who cares why? As a matter of fact, phono-amplifier modules, bought for less than \$5, deliver about 1W output power at low distortion levels. Reason told me to let well enough alone. I'm unreasonable.

The Circuit

I chose a relatively simple circuit from an old Sears & Roebuck company portable receiver. I built it in duplicate for stereo use. The cost of the experiment was small and the pleasure of accomplishment was great. At the same time I learned something about matching complementary pairs. A piece of Vectorboard about 15 x 20 served as the chassis. The photographs are a clear indication of parts placement. The circuit is shown in Fig. 1. Readily available components were used. Miniaturization was not considered. The channels went together easily. I built the left channel first, probably because I'm left-handed. Use of transistor sockets is a must. This is particularly true if, as I have, you have several sacks of bargain transistors bought from *73* advertisers Poly Paks and Meshna stashed away waiting to see if they are compatible and can work as complementary-symmetry pairs. The transistors selected for the circuit I've shown work well at amplification levels from about 1/10 to 1/2W into a 16Ω speaker.

Selecting Transistors

Preliminary selection was made by using a transistor tester built from information contained in an article by Frank Jones W6AJK which appeared in the September 1966 issue of *73* Magazine. This tester provides an

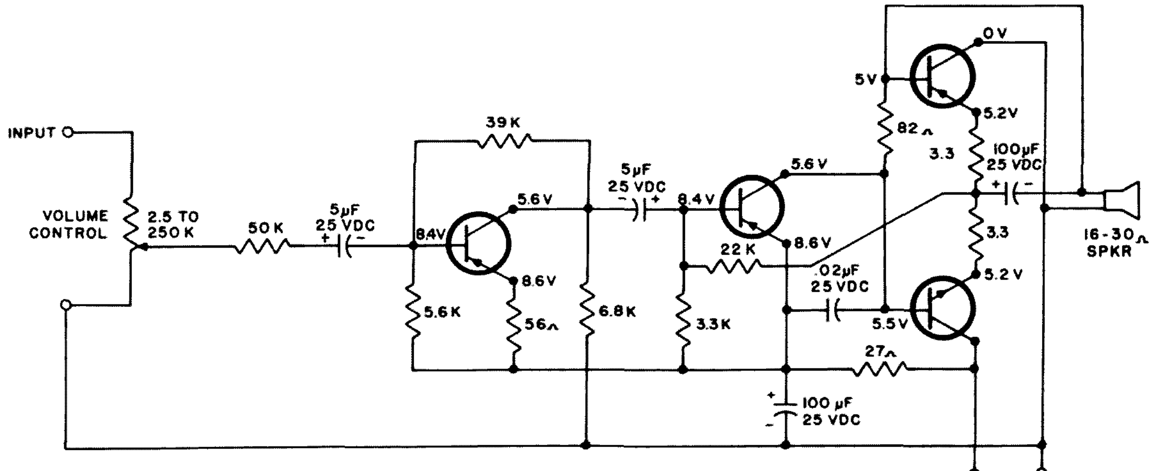


Fig. 1. Schematic of complementary-symmetry pair Class B amplifier.

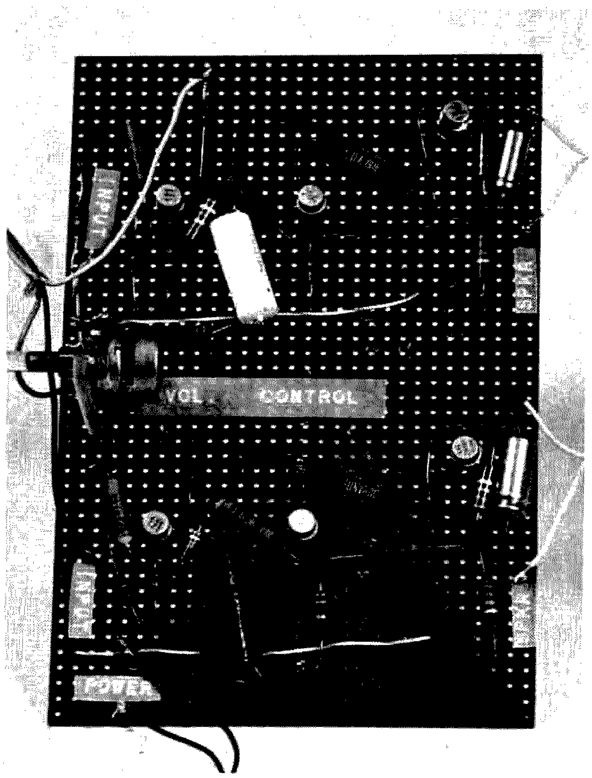
approximate amplification factor when you divide the indicated base current into the indicated collector current. I found that when the NPN and PNP's showed similar dc characteristics, they generally worked as complementary pairs. The PNP transistors used in this experiment are 2N404's. The single NPN in each output stage is a 2N385. If the 2N385 is not available, 2N1206's can be substituted. Other NPN's work in this circuit but not as well as the combinations mentioned. I did not have newer types on hand to try. That is why I chose the 1963 circuit. The transistors used are germanium medium service switching types with an upper frequency limit of 4 MHz.

Testing the Circuit

With 0.5V input, the complementary pair will drive a 16 or 30Ω speaker to at least ½W music power. That doesn't sound like much power, yet in an average room, it is more than a person with sensitive hearing can comfortably stand for any length of time. A 10V supply such as shown in Fig. 2 was connected and power applied. I touched an input terminal with my forefinger to see if there might be some 60 cycle buzz getting through. To my utter surprise, music came burbling from the speaker! (Secret smile and fleeting thought – I knew I had music in my soul, but *finger tips*? There sure is a lot of life in the old boy yet!) Soon the announcer of the local radio station was heard and the fleeting thought disappeared. Well, now, here is an unexpected bonus. A radio set with no tuned circuits. Different lengths of clip leads were hooked to an input terminal until useful volume was achieved. (I had not wired in the volume control.) Here was a high quality test signal with which to check out the complementary pairs without the need to hook up a turntable and flip records. Our local station provides about 0.1 Voltmeter of radio frequency energy at my house. Testing of PNP–NPN's began in earnest. Needless to say, a wide range of distortion is available!

Close Match Required

Close matching betweeen PNP–NPN Class B output transistors is required for the reason that each transistor is driven by the



Top view, complementary-symmetry pair Class B, stereo amplifiers. Photo by Dan Elliott Photo Shop.

same input signal. They respond oppositely to this signal. Any substantial difference in the characteristics of the output pair, such as leakage current, will result in discontinuities at the crossover point for the positive and negative half cycles. When the two half cycles of the amplified waveform do not accurately fit together, high order harmonics are produced which result in discordant speech or music. This is heard as highly objectionable distortion.

No Fly-wheel Effect

In the complementary-symmetry pair circuit there is no transformer to provide a "fly-wheel" effect which might help smooth the crossover swing. Therefore, careful choice of bias must be arranged. Appreciable idling current must flow to assist in avoiding crossover distortion. This type of distortion becomes noticeable in portable receivers when the battery voltage falls below the level which upsets the bias voltage for a given pair of transistors. The circuit I've shown works well between 6 and 10V.

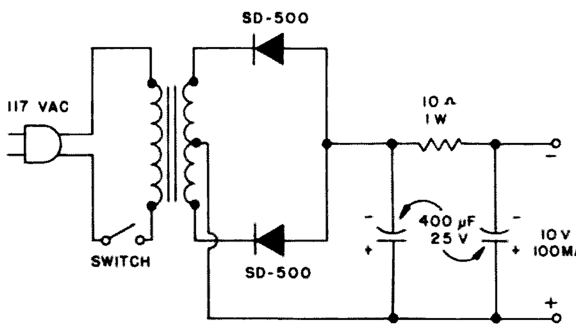


Fig. 2. Schematic of 10V 100 mA power supply.

Reducing Distortion

Those who have worked with Class B tube amplifiers will recall that it was often desirable to place a few volts of positive bias on the grids to aid in reducing crossover distortion. In many transistor circuits a similar scheme is found. This circuit is no exception. A bit of forward bias is used between base and emitter (in the low resistance direction) to overcome crossover dead time and make the amplifier a great deal more linear at all listening levels. In addition, ac and dc feedback is used to improve linearity and to extend the upper frequency limit. Resting current is about 5 mA per channel and depends on the supply voltage. This is perhaps more resting current than is actually needed, and I believe the complementary pair is running Class A at low input levels. The 2N404 and 2N385 data sheets indicate 25V maximum supply to the transistors. That voltage would require more heat sink than I show. 10V is a good compromise. I tried 15V and the 3.3Ω resistors in the emitters were barely able to keep the transistors out of thermal runaway. In 30 minutes the resting current slowly climbed to a higher value. The resting current was also sensitive to temperature. At 50°F and 15V, the transistors tolerated the supply voltage. At 75°F room temperature, they did not and began to show thermal runaway. A vacuum tube voltmeter was used to obtain the voltages shown in the schematic.

Surprise

This investigation of complementary-symmetry circuitry was not without other surprises. For instance, the right channel

broke into a magnificent howl when the volume control was backed off to zero. Apparently the input was effectively connected to the output through some sneak circuit and the feedback loop caused an oscillation which drew more than 100 mA from the 10V supply. This happened only when both channels were in use. Each separately was stable. I didn't check out the howl more than twice because the transistors are rated at 150 mW dissipation. The cure for the trouble wasn't especially scientific, but it was adequate. a 50 KΩ resistor was placed in series with the input base coupling capacitors and the arm of the volume control. This affords a measure of isolation. At the moment I don t know how to prevent such unwanted coupling.

Advantages

An attractive advantage of the PNP–NPN completmentary-symmetry pair is that it can be driven by a single driver transistor. This eliminates the need for phase inverters and/or transformers. Direct coupling between transistors can be used to improve the frequency range. Biasing can be done through the use of conventional resistors.

Conclusion

Simple methods can be used to select transistors for Class B transformerless work. A good starting point can be found in one of *Transistor Substitution Handbook No. 9*. It is advisable to have several transistors of the same kind on hand in order to select those which will work well together. Proper biasing is most important for good linearity with least distortion in the output signal. The new silicon planar transistors are good candidates for complementary-symmetry pair work. From what I can find in the literature, just about all silicons can be used for audio work without regard to their maximum frequency capability. Their low leakage allows direct coupling of audio stages without complicated temperature compensation. Thus a transformer can be eliminated. The major change required is biasing so as to provide about 0.6V base-emitter drop instead of the 0.2V needed for germanium transistors. I plan to try silicons next.

. . .W5SOT

LETTERS

REJECTED LICENSE

I think the time has come to voice my feelings in amateur radio's public print regarding the current status of the FCC's procedures and practices in the area of amateur radio.

For the past 27 years I have been actively involved in radio broadcasting in the engineering and technical phases. During these years I have had ample opportunity to observe the operations of the commission in both the rule-making and regulatory areas. I have never before been as disturbed and uncomfortable as I am now.

This letter is really prompted by the recent rejection of my application for a repeater license by the Washington office of the commission. That rejection has made me stop and think about just what it is that the commission is trying to achieve, and frankly, I fail to understand either it's goals or it's motivations.

As chief engineer of several radio broadcasting operations, including both FM and AM directional stations, I thought that I was in reasonably good condition to present to the commission an application which would be properly set in engineering terms and timely filed. But, apparently I was wrong. The paperwork that I hand carried to Washington ended up in the circular file. The commission, in it's infinite wisdom, did not accept the antenna that I had selected and installed some two years ago, on one of the towers of the AM directional station for which I am responsible. The installation of the antenna was accomplished during some major structural changes to the broadcast system, for which a major proof-of-performance was required on the directional array. I might add that the antenna which I chose and the commission subsequently rejected for lack of type approval is in widespread and common use in the commercial FM mobile radio service for base station applications. But, oddly enough, this antenna does not appear on the mysteriously-generated approved list of the commission.

The question that intriques me is not the commission's reasons for refusing to accept this particular antenna, but rather why the commission has burdened the amateur radio service with approval requirements not deemed necessary in the commercial services. The sad facts for me are that by strict interpretation of the commission's rules, I cannot even remove the antenna from the tower to attempt pattern measurements because that action would immediately generate a problem with the broadcast bureau, to whose rules I am bound regarding the operation and maintenance of the directional array.

After careful consideration I have arrived at the point where I am forced to wonder about the intentions of the gentleman who directs the attitudes and activities of the amateur and citizen's division. What the hell are they trying to prove? Are they not aware that they may be implimenting attitudes that could eventually destroy amateur radio if permitted to continue unchecked along the courses now being pursued????

It is reasonable to question the motives and methods of the individual who directs that division when one examines the manner of grossly restrictive rulemaking being foisted upon the amateur radio fraternity, and compare the same division's activities and attitudes towards it's other area of responsability, the citizen's radio service.

While it is obvious that the people in the broadcast bureau get their paychecks from the same coffers as the people in the amateur and citizen's division, it is also obvious that they don't talk to each other in terms of common policy guidelines and philosophy. The latter organization continues to blithely ignore the widespread malpractice, violation, and chaos rampant in the citizen's radio service, which it is also required to administer, while it concentrates huge efforts on what seem to many of us to be open attempts to put amateur radio out of business. Again I ask what the hell are they trying to prove? To require the amateur radio service to follow rules and procedures not required of comparable commercial services smacks of some kind of perverse thinking. It certainly deserves, if nothing more unflattering, the title of discriminatory treatment.

But again I ask not what they are doing. . .rather, why are they doing it? Is not the commission as a whole bound to be zealous of the public interest? Are not these people paid from our own pockets, servants of the public and thus subject to our overseeing and inquiry as to their actions and attitudes? I, for one, say yes and amen. I am paying their salaries. I am needful of their services. And as their employer, I say that the time has come to demand a full and extensive inquiry into the activities of the men who are at the head of the amateur and citizen's division.

The question I raise is not what they are doing. . .that is obvious. I want to know why they are doing it and what factors are the basis for their totally inequitable attitudes and actions of the past two years.

During these same past two years, we in the broadcasting business, have watched while a series of strikingly well thought out new regulations issue forth from the broadcast bureau. . .rulemaking which is infused with the realization that the state of the broadcaster's art had advanced to the point where the exisiting rules were in dire need of revitalization. And while there is little doubt that the new rulemaking in the broadcasting bureau has much lobby pressure from the industry behind it, it is difficult to find any strong or serious opposition to the sweeping reregulation that has been legislated into broadcasting. Many sacred cows of broadcast law have been swept into the musty archives of history in the past two years. . .the first class radiotelephone license has, for all practical purposes, been delivered to the tender care of the Smithsonian Institute since it is no longer required for anyone except the chief engineer. The old hassle of taking transmitter readings for the operating logs on a half-hourly basis has been relegated to oblivion and stations of all categories, up to and including fifty kilowatt directionals are now permitted full remotely controlled unattended operation with readings to be taken at intervals up to three hours. The previous requirement of daily inspection of the transmitter site has been relaxed in the simpler cases to once every five days, and in the more stringent cases of the remotely-operated high power directional station, to once every fifty-four hours. The old saw of station identification every thirty minutes within two minutes of the hour or half hour has been relaxed to once an hour as near to the hour as is consistent with normal breaks in programming. I could go on ad infinitum quoting a long series of changes and deregulation of the past two years, but I think my point is clear.

I have been pained to see, in the past several years, an unhealthy schism develop within the ranks of amateur radio. Factions dividing the fraternity have served only to generate animosity among us – the spirit of amateur radio. Further, that schism has caused many of us to forget the true goals which amateur radio originally set out to achieve. In useless bickering among ourselves and between the various factions, we have lost track of what we are and where we should be going. We have lost that immense power that lies in unity and

Cont. on page 111

Cont. from page 4.

up with those fantastic numbers in their suits against small businesses – and you can see how so few of them are able to do anything about it except try the best they can to settle – and that means pleading guilty, whether you are or not. It gives the IRS a nice record, but it leaves a lot of bitter people who find few ears willing to listen to their troubles.

By disallowing things that seem like obvious business expenses they can build up a frightening suit against the small businessman. And the first hint that there is anything serious breeding can come as an announcement in the newspaper that you have been indicted for fraud by a grand jury. When you try to find out what the IRS could possibly have told a grand jury to result in this you discover that all doors are closed – you have no way of finding out what was claimed against you other than the amount they claim you and your business owe.

The first hint I had that anything was afoot like this was when someone called to say that the local radio station had a news item that morning that I had been indicted by a grand jury on twelve counts of criminal fraud and that the amount involved was over $100,000. Then it appeared in the paper – and a fellow publisher made sure that all advertisers were aware of the IRS side of the story by sending out photo copies of the newspaper article. One of the ham publications rushed right into print with it– but just the IRS story.

It was quite a few days before I got a copy of the indictment – and even then I didn't know much more. The twelve counts sound dramatic, but actually the IRS disallowed business expenses for the three years 1966-67-68, and they are able to escalate that into twelve counts. It sounds better to the public – and that is apparently the whole object of their scheme – to impress the public and make them afraid of the IRS.

They euphemistically call it the Taxpayer Compliance Program - and the game seems to be to take one defenseless pigeon and call in hundreds of witnesses to the crucifixion so they will all go home and spread the word not to fool with the IRS.

The Watergate mess gives a hint as to how these Gestapo type people operate. They appear to live in a world where anything goes, no matter how dirty or illegal – where postal surveillance means opening your mail and checking it – where wire taps are an everyday occurrence - where frightening witnesses into saying things is the norm. They have their own investigators – their own lawyers– their own courts – and unlimited budgets to crush anyone who tries to stand in their way.

The fear of persecution has kept the press from printing much in the way of IRS horror stories – but every now and then one comes to light where some individual has fought for years through their rigged courts before winning what should have been an open and shut case of acquittal on trumped up charges.

Well, you might say, why didn't you explain what the reasoning was for the business expenses when they examined you? Brother, they never ask you – they just make up their mind, with no comeback possible from you unless you can stand the cost of a jury trial and a very long bitter fight.

And going to trial is something else again, for here you need to line up some expert witnesses to testify about tax matters. Do you know that it is virtually impossible to get anyone on the witness stand, for any money, to do this? The experts are so frightened of IRS retaliation that you can't get them to help you. They've heard all about accountants who have been so persecuted by the IRS that they have committed suicide or died of heart attacks – of firms where every client

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FCC RULES AND REGULATIONS, PART 97 (VI)

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97.111 Operation of a repeater station.

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STATION OPERATION AWAY FROM AUTHORIZED LOCATION

§ 97.95 Operation away from the authorized permanent station location.

(a) Operation within the United States, its territories, or possessions is permitted as follows:

(1) When there is no change in the authorized land station location, an amateur radio station other than a military recreation or an auxiliary link station may be operated under its station license anywhere in the United States, its territories or possessions as a portable or mobile operation, subject to § 97.61.

[§ 97.95(a)(1) amended eff. 10-17-72; VI(72)-1]

(2) When the authorized permanent station location is changed, formal application (FCC Form 610 for an individual station license and FCC Form 610-B for an amateur club or military recreation station license) must be submitted to the Commission prior to any operation and within 4 months of the move for the purpose of modifying the station license to show the new permanent station location. Operation at the new location is permitted under the license for the former station from the date the modification application is mailed until advised of Commission action on that application.

(3) For operations under subparagraphs (1) and (2) of this paragraph, advance notice, as required by § 97.97, must be given to the Engineer in Charge of each radio district in which operation is intended and the portable identification procedures specified in § 97.87 must be used.

(b) When outside the continental limits of the United States, its territories, or possessions, an amateur radio station may be operated as portable or mobile only under the following conditions:

(1) Operation may not be conducted within the jurisdiction of a foreign government except pursuant to, and in accordance with express authority granted to the licensee by such foreign government. When a foreign government permits Commission licensees to operate within its territory, the amateur frequency bands which may be used shall be as prescribed or limited by that government. (See Appendix 4 of this Part for the text of treaties or agreements between the United States and foreign governments relative to reciprocal amateur radio operation.)

(2) When outside the jurisdiction of a foreign government, operation may be conducted within Region 2 on any amateur frequency band between 7.0 MHz and 148 MHz, inclusive; and when not within Region 2, operation may be conducted only in the amateur

bands 7.0–7.1 MHz, 14.00–14.35 MHz, 21.00–21.45 MHz, and 28.0–29.7 MHz.

NOTE: Region 2 is defined as follows: On the east, a line (B) extending from the North Pole along meridian 10° west of Greenwich to its intersection with parallel 72° north; thence by Great Circle Arc to the intersection of meridian 50° west and parallel 40° north; thence by Great Circle Arc to the intersection of meridian 20° west and parallel 10° south; thence along meridian 20° west to the South Pole. On the west, a line (C) extending from the North Pole by Great Circle Arc to the intersection of parallel 65°30′ north with the international boundary in Bering Strait; thence by Great Circle Arc to the intersection of meridian 165° east of Greenwich and parallel 50° north; thence by Great Circle Arc to the intersection of meridian 170° west and parallel 10° north; thence along parallel 10° north to its intersection with meridian 120° west; thence along meridian 120° west to the South Pole.

(3) Notice of such operation, in accordance with the provisions of § 97.97, shall be given to the Engineer in Charge of the district having jurisdiction of the authorized fixed transmitter location.

§ 97.97 Notice of operation away from authorized location.

Whenever an amateur station is, or is likely to be, in portable operation at a single location for a period exceeding 15 days, the licensee shall give advanced written notice of such operation to the Commission's office specified in § 97.95. A new notice is required whenever there is any change in the particulars of a previous notice or whenever operation away from the authorized station continues for a period in excess of 1 year. The notice required by this section shall contain the following information:

(a) Name of licensee.

(b) Station call sign.

(c) Authorized station location shown on station license.

(d) Specific geographical location of station when in portable operation.

(e) Dates of the beginning and end of the portable operation.

(f) Address at which, or through which, the licensee can be readily reached.

[§ *97.97 revised eff. 10-17-72; VI(72)-1*]

§ 97.101 Special provisions for mobile stations aboard ships or aircraft.

In addition to complying with all other applicable rules, an amateur mobile station operated on board a ship or aircraft must comply with all of the following special conditions: (a) The installation and operation of the amateur mobile station shall be approved by the master of the ship or captain of the aircraft; (b) The amateur mobile station shall be separate from and independent of all other radio equipment, if any, installed on board the same ship or aircraft; (c) The electrical installation of the amateur mobile station shall be in accord with the rules applicable to ships or aircraft as promulgated by the appropriate government agency; (d) The operation of the amateur mobile station shall not interfere with the efficient operation of any other radio equipment installed on board the same ship or aircraft; and (e) The amateur mobile station and its associated equipment, either in itself or in its method of operation, shall not constitute a hazard to the safety of life or property.

LOGS

§ 97.103 Station log requirements.

An accurate legible account of station operation shall be entered in a log for each amateur radio station. The

log shall bear the call sign of the station and the signature of the licensee. The following information shall be recorded as a minimum:

(a) Written entries for all stations which are required only once, or when there is a change thereto.

(1) The signature of the control operator on duty and the call sign of his primary station, if he is other than the station licensee.

(2) The location of the station. Stations in mobile operation may enter the word "local" for amateur radiocommunication conducted within 100 statute miles of the address shown on the station license, otherwise the location of the first and last radiocommunication of each day. Stations in mobile or portable operation shall make an entry showing compliance with § 97.97, if required.

(3) The input power to the transmitter final amplifying stage.

(4) The type of emission used.

(5) The frequency or frequency subband used for transmitting.

(b) Other entries for all stations which may be recorded in a form other than written but which can readily be transcribed by the licensee into written form:

(1) The dates of operation.

(2) Except for repeater stations, names of persons other than the control operator using the station, either directly or indirectly, for amateur radiocommunication.

(3) A notation of third party messages sent or received, including names of all participants and a brief description of the message content.

(4) The call sign of each station actually contacted, or other purpose of the transmission, i.e., those set forth in § 97.89. Stations in mobile operation and repeater stations may omit this entry. Control stations shall enter the call sign(s) of each station in the control link. An auxiliary link station shall enter the call sign of its associated station(s).

(5) All stations shall enter the times the station is put into, or taken out of, service. Stations other than those in mobile operation, control stations, auxiliary link stations, and repeater stations shall enter the times of commencing and terminating each exchange of radiocommunication.

[§ *97.103 revised eff. 10-17-72; VI(72)-1*]

§ 97.105 Retention of logs.

The station log shall be preserved for a period of at least 1 year following the last date of entry and retained in the possession of the licensee. Copies of the log, including the sections required to be transcribed by § 97.103, shall be available to the Commission for inspection.

[§ *97.105 revised eff. 10-17-72; VI(72)-1*]

Emergency Operations

§ 97.107 Operation in emergencies.

In the event of an emergency disrupting normally available communication facilities in any widespread area or areas, the Commission, in its discretion, may declare that a general state of communications emergency exists, designate the area or areas concerned, and specify the amateur frequency bands, or segments of such bands, for use only by amateurs participating in emergency communication within or with such affected area or areas. Amateurs desiring to request the declaration of such a state of emergency should communicate with the Commission's Engineer in Charge of

the area concerned. Whenever such declaration has been made, operation of and with amateur stations in the area concerned shall be only in accordance with the requirements set forth in this section, but such requirements shall in nowise affect other normal amateur communication in the affected area when conducted on frequencies not designated for emergency operation.

(a) All transmissions within all designated amateur emergency communication bands other than communications relating directly to relief work, emergency service, or the establishment and maintenance of efficient amateur radio networks for the handling of such communications shall be suspended. Incidental calling, answering, testing or working (including casual conversation, remarks or messages) not pertinent to constructive handling of the emergency situation shall be prohibited within these bands.

(b) The Commission may designate certain amateur stations to assist in the promulgation of information relating to the declaration of a general state of communications emergency, to monitor the designated amateur emergency communications bands, and to warn non-complying stations observed to be operating in those bands. Such station, when so designated, may transmit for that purpose on any frequency or frequencies authorized to be used by that station, provided such transmissions do not interfere with essential emergency communications in progress; however, such transmissions shall preferably be made on authorized frequencies immediately adjacent to those segments of the amateur bands being cleared for the emergency. Individual transmissions for the purpose of advising other stations of the existence of the communications emergency shall refer to this section by number (§ 97.107) and shall specify, briefly and concisely, the date of the Commission's declaration, the area and nature of the emergency, and the amateur frequency bands or segments of such bands which constitute the amateur emergency communications bands at the time. The designated stations shall not enter into discussions with other stations beyond furnishing essential facts relative to the emergency, or acting as advisors to stations desiring to assist in the emergency, and the operators of such designated stations shall report fully to the Commission the identity of any stations failing to comply, after notice, with any of the pertinent provisions of this section.

(c) The special conditions imposed under the provisions of this section shall cease to apply only after the Commission, or its authorized representative, shall have declared such general state of communications emergency to be terminated: however, nothing in this paragraph shall be deemed to prevent the Commission from modifying the terms of its declaration from time to time as may be necessary during the period of a communications emergency, or from removing those conditions with respect to any amateur frequency band or segment of such band which no longer appears essential to the conduct of the emergency communications.

Operation of Additional Stations

§ 97.108 Operation of a remotely controlled station.

(a) An amateur radio station may be operated by remote control only from an authorized control point, and only where there is compliance with the following:

(1) The license for the remotely controlled station must list the authorized remote control point(s). A photocopy of the remotely controlled station license must be posted in a conspicuous place at the authorized control point(s), and at the remotely controlled transmitter location. A copy of the system network diagram on file with the Commission must be retained at each control point. The transmitting antenna, transmission line, or mast, as appropriate, associated with the remotely controlled transmitter must bear a durable tag marked with the station call sign, the name of the station licensee and other information so that the control operator can readily be contacted by Commission personnel.

(2) The control link equipment and the remotely controlled station must be accessible only to persons authorized by the licensee. Protection against both inadvertent and unauthorized deliberate emissions must be provided. In the event unauthorized emissions occur, the station operation must be suspended until such time as adequate protection is incorporated, or there is reasonable assurance that unauthorized emissions will not recur.

(3) A control operator designated by the licensee must be on duty at an authorized control point while the station is being remotely controlled. Immediately prior to, and during the periods the remotely controlled station is in operation, the frequencies used for emission by the remotely controlled transmitter must be continuously monitored by the control operator. The control operator must terminate transmission upon any deviation from the rules.

(4) Provisions must be incorporated to automatically limit transmission to a period of no more than 3 minutes in the event of malfunction in the control link.

(5) A remotely controlled station may not be operated at any location other than that specified on the license without prior approval of the Commission except in emergencies involving the immediate safety of life or protection of property.

(6) A repeater station may be operated by radio remote control only where the control link utilizes frequencies other than the repeater station receiving frequencies.

[§ 97.108 added new eff. 10-17-72; VI(72)-1]

§ 97.109 Operation of a control station.

(a) Amateur frequency bands above 220 MHz, excepting 435 to 438 MHz, may be used for emissions by a control station. Frequencies below 225 MHz used for control links must be monitored by the control operator immediately prior to, and during, periods of operation.

(b) Where a remotely controlled station has been authorized to be operated from one or more remote control stations, those remote control stations may be operated either mobile or portable.

[§ 97.109 added new eff. 10-17-72; VI(72)-1]

§ 97.110 Operation of an auxiliary link station.

(a) An auxiliary link station may use amateur frequency bands above 220 MHz excepting 435 to 438 MHz for emissions. Frequencies below 225 MHz used by an auxiliary link station shall be monitored by the control operator immediately prior to, and during, periods of operation.

(b) An auxiliary link station may only be used for fixed operation from the location specified on the station license, and only when its associated station(s) is operated from its authorized land location.

[§ 97.110 added new eff. 10-17-72; VI(72)-1]

§ 97.111 Operation of a repeater station.

(a) Emissions from a repeater station shall be discontinued within 5 seconds after cessation of radiocommunication by the user station. Provisions to automatically limit the access to a repeater station may be incorporated, but are not mandatory.

(b) The transmitting and receiving frequencies utilized by the repeater station shall be continuously monitored by the control operator immediately prior to, and during, periods of operation.

(c) A repeater station may be concurrently operated on more than one frequency band, provided the necessary showings have been approved by the Commission for each frequency band of operation. Crossband operation of repeater stations is prohibited, i.e. both input (receiving) and output (transmitting) frequencies for a particular repeated transmission must be within the same frequency band. Operation on more than one output frequency on a single frequency band is prohibited except when specifically approved by the Commission. Repeater stations authorized to operate in conjunction with one or more auxiliary link stations may utilize an input frequency in a different frequency band provided the input frequency of the auxiliary link station(s) is in the same frequency band as the output frequency of the repeater station.

(d) A repeater station shall be operated in a manner so as to assure that the station is not used for one-way radiocommunication other than provided for in § 97.91.

(e) A station licensed as a repeater station may only be operated as a repeater station, excepting for short periods for testing or for emergencies.

[§ 97.111 added new eff. 10-17-72; VI(72)-1]

(To be continued next month.)

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

WANTED: W.W.V. comparator, Lavoie LA-8000 or like equipment. Also need manuals for Lavoie. Stephen Gansky WA3AAO, Oak Hill Apts. N-408, Narberth PA 19072 215-664-0648.

SELL OR TRADE Hasselblad 500C camera with accessories $1250, or factory sealed new 7553C or make offer! SASE for info. Jim K4YBB, 942 N. W. 116 St., Miami FL 33168.

PITTSBURGH Area Hams two improved lots for sale, Highest point in Allegheny County. Call WA8GFR evenings or weekends, 216-941-4751.

MUST SELL: New Signal One CX7A. Instruction & schematic manuals included., $1300. Contact Lewis Grigsby Jr., Farmers State Bank, Pittsfield IL 62363 217-285-2194.

WE BUY late model Collins-Drake–Swan, top prices, cash, Assocaited Radio, 8012 Conser Overland Park, Kansas, 66204, Call: 913-381-5901.

ATTENTION C.A.P.ers, Regency RE-CAP2 with ASP-117 Antenna $130, Hammarlund FM-50A with accessories, manual, Xtal's and GAM TG2 antenna $90, Heath HM-2102, VHF Wattmeter $20, Pat Butler, 1833 N. Indiana, Peoria IL 61603.

COMPLETE 36 page QSL catalog, 3rd edition. New "SPARKLING" QSLs. Hundreds of cuts, ten report forms, thriteen colored stocks, 25¢. Ten sample QSL cards. Comeilson's Quality QSLs, 321 Warren St., N. Babylon, N. Y. 11704.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis. Please send Money Orders or Certified Checks only to 73 Magazine, Peterborough NH 03458.

Cap-Com 40m solid state SSB xcvr	$150
Heath IB-101 counter with Vanguard Scaler	$250
Clegg 27B 2m xcvr	$380
IC-22 2m FM xcvr	$246
Midland 13500 2m xcvr	$200
Midland 13509 220 xcvr	$200
Tempo CL-220 220 xcvr	$200
Clegg FM-21 220 xcvr	$255
Regency HR-6 6m xcvr	$190
HR2MS 8 channel scanning 2m xcvr	$255
TME-H-LMU 16 channel rcvr	$255
Digital Logiclocks	$ 80
Dycom 2m repeater	$425
Wilson 7 element 10 & 15m beam (pick-up only)	$250
Waller 60A power supply	$105
Standard sr-c 120/5 power sup.	$ 44
Gladding 12V power supply	$ 60
SBE Scannavision	$650
Robot Monitor	$265
Robot Camera	$265
AX 190 amateur rcvr	$200
SX 190 SWL rcvr	$200
Pickering KB-1 keyboard	$200
TPL 502-B 2m Amp 1w/40w	$110
TPL 502 2m Amp 10w/45w	$ 90
Heath HW-202 w/encoder	$180
Heath HWA-202-1	$ 30
Heath HA-2022 amplifier	$ 70
Gladding 8 channel scanner	$110
Gladding HI-Scan	$150
Regency TMR-8-U Scanner	$140
Tempo fmh charger	
Heath HM-2102 wattmeter	$ 30
GTX-2 FM xcvr	$225
Newsom 2m KW amplifier	$350
Temp-ONE SSB xcvr	$275
External VFO	$ 80
AC-One power supply	$ 80
FPM 300 SSB xcvr	$480
Heath IC-2009 calculator	$ 90
SBE 450 FM xcvr	$340
MITS calculater w/ac adaptor and case	$130
Memory-Matic 8000	$320

FACSIMILE PAPER for DeskFax units: $1.95 per box. 6 boxes for $10.50; for weathermap recorders; $4.25 per box, 4 boxes for $16. Jim Cooper, P. O. Box 73, Paramus NJ 07652.

WANTED: ARC-5/VHF components. Mounting Backs MT-65 and MT-71. Control Unit C-42, Junction Box J-28. Also need connectors. WB8NLM, 146 Schonhardt St., Tiffin OH 44883.

"BRAND NEW": Clegg 66er in original factory carton, $145. Money order or certified check. J. A.LaTorre, P. O. Box 521, Lawrence MA 01842.

COLLINS FOR SALE: Individual prices are indicated. For package deals please write. 32S3 SN 12091 $650, 75S3 SN 14276 $600, KWM 2 A SN 11535 $750, 516F2 P. S. $75, 312B4 station control $125, 30L1 linear amp $350. Jack Aviv, WA2KNC, 106 Glenn Avenue, Lakewood NJ 08701.

CANADIANS – FREE 120 page electronics catalog ETCO-B, 464 McGill, Montreal.

DESK-FAX TRANSCEIVERS as removed from commercial service (working). $14.95 each, or $25 pair. Jim Cooper, P. O. Box 73, Paramus NJ 07652.

MOBILE IGNITION SHIELD gives more range, no noise. Everything from economical suppression kits to custom shielding. Literature. Estes Engineering, 543-S West 184th Street, Gardena, Calif., 90248

MOTOROLA P33-BAC 5W Handi-Talkie, excellent condition with antenna, mike, Ni-Cads, 34/94 and 94/94 – $95; Heath HX-20 80-10 meter SSB and CW transmitter, HR-20 80-10 meter SSB, CW, and AM receiver, and HP-20 AC power supply, good condition – $195. FOB, W5PNY, 2506-A, 35th St., Los Alamos NM 87544.

PLEASE donate all of your unused amateur equipment, any ham band, to, Association for the Blind ARC, 1844 Broadway, Kansas City MO.

"DON AND BOB" new guaranteed buys. Discount prices plus full warranty. Write for low prices: Hy-Gain TH6DXX, TH3MK3, 204 BA, DB1015A, 402BA; Mosley CL33, CL36, S402; Triex MW50, MW65, W51 (FOB, Cal); Midland 13500 $219.95, 13520 W-T $209.95; Regency HR2B; SBE 144 $199.95; Standard 826 MA, 146A; CDE Ham-M $99.00, TR44 $59.95, AR22R $31.95, Belden 8448 rotor cable 10¢/ft; Belden 8214 RG8 FOAM 17¢/ft; 8237 RG8/U 15¢/ft; Amphenol PL259 49¢; Hallicrafters FPM300 new demos, factory warranty repair needed, $460.00 each; Rohn 25G, 45G tower, accessories stock; Used guaranteed: Collins 75A4 $345.00, Kenwood R599 $300.00; T599 $350.00, write demo prices; Heath SB300, filters $250.00; Write quote Swan, Drake, Eimac; Motorola HEP 170 epoxy diode 2.5A/1000 PIV 29¢, $25.00/100 Lot; 1972 Radio Masters $3.50; Motorola Semiconductor Data Series $7.50; Calrad dual-meter SWR-relative power meter, to 150 MHz $15.95; #15 antenna wire $1.95/C; Write quote items not listed. Shipping charges collect. Madison Electronics, 1508 McKinney, Houston, Texas 77002. 713-2242-668 Nite/weekend 713-497-5683.

W2NSD/1 cont. from page 102

has been audited. This drives accountants out of business in a hurry.

The whole IRS system is pernicious. Look what it does to judges—they are frightened too. No one is safe from an audit – and, as Milton Friedman pointed out recently in Playboy in an interview, no one is safe from being arrested and put in jail by the IRS on fraud, no matter how honest they are. Judges have to be extra careful with their careers if they want to move ahead—and what judge doesn't have an eye on the Supreme Court bench? A big black tax suit in his record could ruin him.

The system is no better on the IRS agents themselves, who are prisoners of a soul-destroying situation. They *have* to produce. When they audit they are expected to come up with money. And promotion is tied in with money produced, even though this is not the official policy of the IRS—this is the way it works. And an agent that loses a case loses his career and may end up as a bail bondsman in Fitchburg, Massachusetts. This results in desperate measures being brought against taxpayers and is the main reason why they stoop to phone taps and mail checking.

How far will they go? Well, our old records are not locked up with extreme care, and they have been gone over by the IRS agents several times. I recently went through what we had left to see what some of the checks might be that they had brought up as being personal expenses. Every single record that we had of cancelled checks, invoices, all such records were missing. Were they kept by IRS agents? Did someone sneak into our attic and steal those particular papers, leaving all other records such as subscription sales, book sales, payments for articles, adverttising sales, bulk sales, newsstand sales . . . etc? Weird.

This Gestapo-type branch of the legislative part of our government will operate in this way just as long as everyone is afraid of them and no one does anything to back them down. The revelations during the Watergate hearing of IRS use for political harassment brought this situation into the light for many taxpayers for the first time. The people who don't want to be bothered with this sort of mess are the ones that keep it going—and they are the ones who will get caught up and trampled eventually.

Now that the FBI has been backed off a bit – and the CIA is taking it easier – perhaps it is time to stop the really vile things that IRS is doing and get us a little more away from being a police state.

You can bet that I'll be taking notes on this case and let you know just what kind of police-state tactics are used against me. Frankly I don't see how the case can end up with anything but an apology from the IRS and perhaps even a prosecution of one or more of their agents for perjury.

Watch for more news.

SEPTEMBER REPEATER TEST

Are the new repeater rules being observed?

Repeater groups seem to agree that the new regulations not only are without the saving grace of reason, they are also extremely repressive. Now that all of the new regulations are in effect, how many repeater groups are abiding by them and how many are ignoring them – a la our more successful cousins on 27 MHz?

A test was made in mid-September to get a feel of how things are going. A team set up a test site on a high mountain and checked the number of repeaters on the various channels which were heard in a period of 10:00 to 10:30 PM, noting the number on each channel. Then, the next morning at 5:00 to 5:30 AM the same test was made. The results may be of interest. During the morning test a transmission was made four times on each channel asking if there was anyone on channel. No answers were received on any channel.

There were 30 repeaters clearly heard in the evening test. Twenty-five were there in the morning test. Fifteen of the twenty-five had identification. Only three of the five repeaters which had been turned off for the night had identification in the night test.

This would indicate that in this test 10% of the repeaters were operating according to the identification and monitoring rules. 83% were staying on the air and not being turned off at night. Ten had WR calls (30%).

So here we have about 90% of the active repeater groups openingly flaunting the regulations. This is historical, in a way. In the past repeater

groups have always been in the forefront of legality — bending over backwards in most cases to make sure that everything was according to Hoyle. They haven't caught up with the CBers yet in their open disdain for rules, but it seems obvious that Walker has found a way to destroy the time-honored rapport between the FCC and the amateurs.

18803 RECONSIDERATION

In early August FCC Chairman Dean Burch called in response to the furor over the repeater regulations and suggested that a hearing be organized to familiarize the Commissioners with the scope of our problems and the proposed changes in the regulations that might set things right.

Chairman Burch agreed to have the seven Commissioners attend the hearing and I promised to have representatives of the major repeater councils present to present the case and answer any questions.

Mr. Burch further asked that a paper be provided the Commissioners a month before the hearing to familiarize them with the problems and suggested rule changes.

The above may come as quite a shock to the ARRL HQ staff who have been urging conciliation with Walker and who have been openly critical of my efforts to get through to a level that could help us get the changes we need. Hollaring does work now and then.

The hearing is scheduled for January 14th in Washington and I plan for those council representatives who are going to help with the hearing to be in Washington a day early so that the schedule for the presentation can be worked out carefully and areas of expertise be established for answering questions.

I have already been in contact with many of the major repeater councils and have asked each for a resume of the problems posed by 18803 — the proposed changes in the regulations — and the reasons for these changes.

If there are any councils that have not been contacted and who wish to field a representative for this critical hearing, please get in touch with me. There are several requirements, and they are important. A rep must be very familiar with both repeaters and the regulations — he must be well spoken and not given to any unnecessary talking — he must be able to think fast and not get sidetracked by personal questions or problems of his repeater — his group must furnish me with a resume of problems and proposed changes by November 15th — and he must appear in Washington at his or the council's expense for the hearing. I hope that sounds reasonable.

In my past talks with FCC officials I have found that a great deal of their time has been wasted by excursions into individual problems — and listening to amateurs who have a serious need to talk, but who listen very little. It is unfortunate that there are quite a few repeater owners who suffer from this problem. One in Connecticut comes to mind immediately — a chap who is a laughing stock at the Commission because his problem is so serious.

This is our chance to get the word right to the top — and, as far as I know, this is the first time anything like this has ever happened. I suspect that the July 9th session with the ARRL may have helped to open the ear to our troubles.

By the way, the hearing is for the purpose of discussing regulations already enacted, not any under consideration, so we'll have to soft pedal our screams of anguish on the 224 MHz CB proposal and stick to the repeater rules. There's plenty there to keep us busy.

FCC ACCUSED!

The Bureau of National Affairs, an organization which supplies legal and financial data to businessmen, recently charged that the FCC has become a haven for attorneys who are failures at the bar. The BNA pointed out that about 25% of the lawyers hired last year by the FCC failed the bar exams they were required to take.

No wonder the amateur regulations have gotten so screwed up in the last year! (Thanks WN5GUN)

NEWSWEEK ATTACKS TOO

The September 10th issue of Newsweek (page 53) put CB in fair perspective and this publicity should help to slow down the FCC's anxious drive to please the EIA at all costs. The false cry for help in New Mexico made headlines all over the country and helped to blacken the eye of CB — two hundred rescurers and 22 planes involved in the search — hoax. (Thanks W9BOZ)

WRITING CONGRESS SIMPLIFIED

Rather than have to sit down and work out a long and complicated letter to your congressman explaining what the problems are and what you would like him to do about it — a writing chore that manages to knock out about 99.99% of the letters that might otherwise get to congress — 73 has prepared a short newsletter (two sheets) which outlines the whole situation.

This newsletter is available for free from 73 Magazine — send a self-addressed stamped envelope (business size).

The newsletter discusses the purposes of amateur radio and how we are meeting those purposes with great success. It goes into the main areas of communications that amateurs have pioneered — and this is just about every major communications technique in use today. It explains why amateurs need help now, outlining some of the devasting regulations Walker has laid on us.

There is a brief explanation of why all of the major developments in communications have been made by amateurs — and also an explanation of what repeaters are and how they work. Just in case your congressman is not sure of the difference between CB and hams, this is also covered.

The ending of the paper tells your congressman how he can help us — and you.

Remember — it is extremely important to write to your congressman and to your senators — and it won't hurt to send along a copy of this letter we have made for you.

Why haven't we just bulk mailed the letter to congress? Because it takes your personal covering letter to get it past the round file in the mail room. We've worked hard to make this for you — will you help by seeing that it gets where it should?

When writing that covering letter, address it as follows — for,

Representatives:

The Honorable
House of Representatives
Washington DC 20515

Dear Mr.

and for Senators:

The Honorable
United States Senate
Washington DC 20510

Dear Senator

The address for the newsletters is 73 Magazine, Peterborough NH 03458, and don't forget the SASE.

FCC MEN GRIPE!

A little note in the Federal Times said that career civil servants in the FCC have been griping at the large number of ex-military men who have been brought in by an ex-Air Force officer. One division of the Commission has been called a "little Pentagon." (Thanks WB5BKM)

. . . WAYNE

Cont. from page 98

common purpose because we have allowed ourselves to become divided. And unless this senseless division is healed and until the fraternity has been reunited in vigorous pursuit of it's objectives, we will remain ineffective and powerless to stand up and fight for our priviledges which are in certain jeopardy.

The FCC is empowered to regulate the communication art by the Act of Congress of 1934, as amended. And I suggest that every concerned amateur look into this document which can be found in many public libraries and is available for a nominal charge from the United States government printing office. See what it is that the FCC is empowered to do and determine for yourself whether or not the amateur and citizen's radio service division is living up to those responsabilities with which it is charged. If you find, as I have, that there are questions to be answered and satisfaction required, then sit down and write your elected representatives, your senators, your congressmen, noted hams who are in the public eye. . .and there are many of them. Forget about which faction you belong to, or which magazine you subscribe to, or which publisher's views you adhere to, or what you feel about this or that league. Remember that you are a member of a unique fraternity of communicators and technicians and that the really important thing right now is the survival of the fraternity under honest and realistic regulation. Don't ask for anarchy. . . ask for common sense application of logic in rulemaking.

If enough of us can see the real and hidden dangers in the present situation, there may be hope yet and time yet. But, if we wait for the other guy to do the job, we will all be lost.

Norman Joseph Sternberg
W2JUP/WB2ZWR
Levittown NY

AMEN!

HAM SOLITUDE

Just finished renewing my subscription to "73" for two more years.

Since I'm the only amateur radio operator in Big Stone City, S. Dak., I'm glad to have a friend like "73" to keep me up to date on the latest goings-on in the amateur radio world. Keep up the good work.

David L. Martin, Sr. WBØCIY

WANT A GUEST?

I wonder if there are amateurs in England, Europe, and Scandinavia who would enjoy a visit from a travelling American ham. I'm planning on making a trip to these areas next summer and as I found out last summer, a trip can be made much more enjoyable by having contacts with foreign hams.

Jon Forrest WB6EDM
21414 De La Osa St.
Woodland Hills CA 91364

ATTENTION ADVERTISERS

I quit the League in 1963, also the firms that cut you off their advertising budgets. How stupid they were, they cut off the wrong outfit and made a helluvamess.

I noted that one of the firms which I stopped patronizing in '63 began to advertise in 73 in February of this year. I read the ad, and on my way to Portland stopped off to see a friend in Albany where I looked at the new FPM300 Hallicrafter transceiver, tried it out – then didn't go to Portland! Came directly home with a new 300. If I hadn't seen their ad in 73, I wouldn't have even looked at it, as I was going to Portland to buy another make. Chalk up one for 73. When I registered the new 300, I said I saw the ad in 73 and hadn't bought any Hallicrafter equipment since 1963. There wasn't much room on the registration card, but I was able to imply that the big outfits should have gotten into the fight to save ham radio.

Keep slugging, Wayne.

Paul J. Rasmussen K7EML
Sutherlin OR

LOBBY

I agree with you that ham radio needs more political support in Washington. Probably a lobby is the answer, and I would be willing to contribute money to support one.

Ivan T. Schultz, M.D. WØFDM
Benedict MN

SUCCESS STORY

I would like to compliment you on your fine magazine – especially the great construction articles. I have recently finished a homebrew project using IC's and printed circuit board. I don't remember what it is supposed to be as I misplaced the issue of 73 I built it from.

As most people do, I made several slight changes in the design. I eliminated the power supply as my house has 110 volt outlets all over and I could conveniently plug this little gem in wherever I wished – even in my ham shack. The black areas are soot from the smoke that poured forth when I first *fired* it up. I thought this was going to be a recurring problem but it hasn't happened since.

Hope to see more of the same solid state construction articles and also high power transmitter and amplifier projects. I really want to get my hands into something that uses 5 kV or so.

By the way, does it really save money in the long run to get a life membership to 73 Mag?

Jack R. Main W4YCZ
Norfolk VA

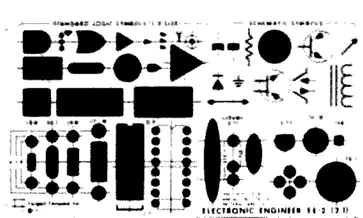
If you start applying 5 kV to your IC projects it will certainly save US money!

(More New Products)

ing of *Engineering Drawings* of a electrical components. All physical dimensions are given to allow efficient design of electronic "packages" before components are purchased.

Allied has also introduced a new policy for obtaining their catalog: instead of the $5 price, or $10 order requirement, *anyone* can now obtain their catalog for the cost of postage and handling. For your copy, send $1 for postage and handling to: *Allied Electronics, 2400 W. Washington Blvd., Chicago IL 60612.*

P-C DESIGN TEMPLATE



The *Electronic Engineer* template series incorporates on each template the most useful logic, schematic and component layout patterns necessary for the majority of electronic circuit design requirements. Each template features a complete set of usable schematic and logic diagrams. Also included are the basic component layout patterns required for laying out scaled printed circuit board designs. Featured are basic resistors, capacitors and semiconductors used in most electronic equipment.

The templates are made from green tinted plastic and are priced as follows: EE-1 (1:1) $4, EE-2 (2:1) $5 and EE-4 (4:1) $7. The ratio indicates the size of the component layout patterns featured on each template. Contact: *Tangent Template, Inc., P. O. Box 20704, San Diego CA 92120.*

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☐	146.28–88	☐
☐	146.31–91	☐
☐	146.34–94	☐
☐	146.37–97	☐
☐	146.40–147.00	☐
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☐	147.96–36	☐
☐	147.93–33	☐
☐	147.90–30	☐
☐	147.87–27	☐
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- ☐ Swan FM2X
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Eastern customers may appreciate our fast mail service . . . it can save you days to weeks on your order. Western customers may appreciate getting crystals that work on channel the very first time and don't have to be returned for further compensation to match your set.

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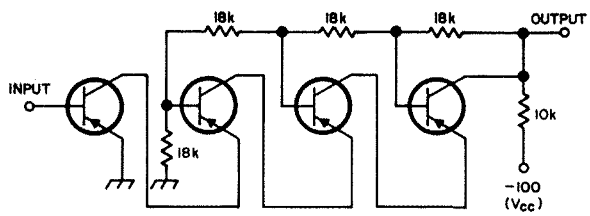
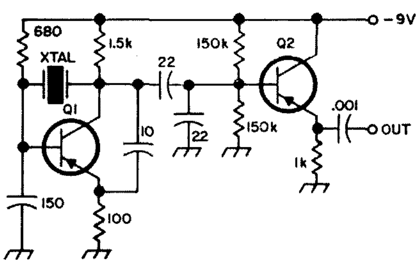
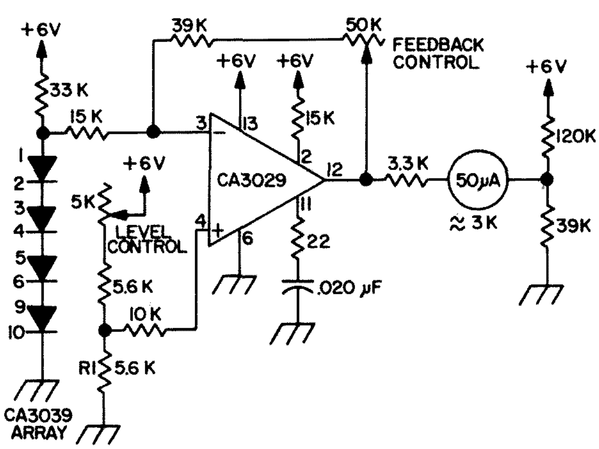
A FEW CIRCUITS...



High voltage direct coupled amplifier. The gain of this amplifier is equivalent to both sections of a 12AU7. All transistors are SK3008, GE-9 or HEP-51.



This untuned crystal oscillator will oscillate with any crystal from 300 kHz to 10 MHz. Frequency stability is very good because the emitter follower buffer amplifier effectively isolates the oscillator from the load. Q1 and Q2 are GE-9, SK30006 or HEP-2.



An electronic thermometer using the CA3039 diode array as the sense element. A CA3029 op amp detects the change in voltage fed into it by the diodes against the level control's reference voltage and displays the amplified difference on the meter. The level control should be set so room temperature reads near mid-scale, while the feedback control adjusts the upper and lower extremes of 120°F and 0°F. From "Handbook of IC Circuit Projects," by Tab Books.

PHASE LOCK

73 MAGAZINE — STAFF — READERS — AMATEUR RADIO

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November 1973

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4	5	6	$\boxed{7}$	8	$\boxed{9}$	10
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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
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ARGENTINA	14	7	7	7	7	7	14	21	21	21	12	14A
AUSTRALIA	14	7B	7B	7B	7B	7B	7	14	14	14	14	14A
CANAL ZONE	14	7	7	7	7	7	14	21	21A	21A	21	14
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WEST COAST	14	7A	7	7	7	7	7	14	14A	21	21	14A

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ALASKA	14	7A	7	3	3	3	3	7	7A	14	14A	14A
ARGENTINA	14	7	7	7	7	7	14	21	21	21	21	21
AUSTRALIA	21	14	7B	7B	7B	7B	7	7	14	14	14	21
CANAL ZONE	14	7A	7	7	7	7	7	14	21	21A	21	21
ENGLAND	7	7	7	3A	7	7	7B	14	14A	14	7B	7
HAWAII	21	14	7	7	7	7	7	7	14	21	21	21
INDIA	7	7	7B	7B	7B	7B	3B	7A	7A	7	7	7
JAPAN	14	7A	7B	7	7	7	3A	7	7	7	7B	14
MEXICO	14	7	7	7	7	3A	3A	14	14A	14	14	14
PHILIPPINES	14	7A	7B	3B	7B	7	3A	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	14	14A	21	21	21	14
SOUTH AFRICA	14B	7	7	7	7B	7B	14	21	21A	21	21	14
U. S. S. R.	7	7	3A	3A	7	7	7B	14	7A	7B	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	3	3	3A	3	3	7	14	14A	14A
ARGENTINA	14A	14	7	7	7	7	7	14	21	21	21	21
AUSTRALIA	21	14A	14	7B	7B	7B	7	7	14	14	14	21
CANAL ZONE	14	14	7	7	7	7	7	14	21A	21A	21	21
ENGLAND	7	7	7	3A	7	7	7B	7B	14	14	7B	7B
HAWAII	21A	14A	14	7	7	7	7	7	14	21	21	21A
INDIA	7	14	7B	3B	3B	7B	3B	7	7	7	7	7B
JAPAN	21	14	7B	7	7	7	7	3A	7	7	7	14
MEXICO	14	14	7	7	7	7	7	14	21	21	14A	14
PHILIPPINES	21	14	7B	7B	7B	7	7	3A	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	21	21	21	14A
SOUTH AFRICA	14B	7	7	7	7B	7B	7B	14	21	21	21	14
U. S. S. R.	7	7	7	3A	3A	7	3A	7	7A	7B	7B	7B
EAST COAST	14	7A	7	7	7	7	7	14	14A	21	21	14A

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 magazine

for radio amateurs

$1.00

December 1973

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SOLID STATE

Proudly Presents . . .

their NEW CATALOG!

73 magazine
for radio amateurs

#159 DECEMBER 1973

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This month a crowd gathers to witness the sailing of the Spanish Armada.

Cover girl Linda is 22, single, native Floridian, college grad, loves horseback riding and works as a school teacher, legislative assistant and models for W4PPC, who took the cover picture. George is president of George Singer Creative Services on Key Biscayne. Linda's measurements are 89-58-91 (cm). . .kinda makes you want to go metric, doesn't it?
Poster available: A full color 11x14 enlargement of this lovely cover picture, without that obstructing package, is available from 73 Magazine, Peterborough NH 03458, for $3. Now there's a way to dress up the shack!

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year; in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Three years, $14, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54942 U.S.A.

Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor, MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.

Amateur Radio

DECEMBER MCMLXXIII | Monthly Ham

AMATEUR AIDS RABIES VICTIMS

A mother and daughter were saved from the dreaded ravages of the rabies disease by the alert action of Jim Brooks KG4FU of the U.S. Naval Base at Guantanamo Bay, Cuba.

The story began during the morning hours of 3 October 1973 when Jim received a call from Cesar HP4CK of Changuinola, Panama to help in relaying an urgent medical message into Ghana, Africa.

According to the message from Cesar, the wife and daughter of Mauro Chattaneo from Tema, Ghana had been bitten by a dog while visiting South America. Ten days later the dog was found to be rabid.

Jim, fearing that time was critical and suspecting that propagation into Africa would be difficult, drafted a message to the American Embassy in Ghana and sent the message on circuits outside of the amateur bands informing them of the situation.

A message was later received from the embassy informing Jim that the Cattaneo family had begun appropriate medical treatment.

CLEGG UPDATES 220 REPEATER LEASING PROGRAM

In its continuing efforts to bring 220 MHz activity to radio amateurs from coast to coast, Clegg is now offering two lease options and one option to purchase its Model 106 self-contained, 220 MHz repeater with duplexer.

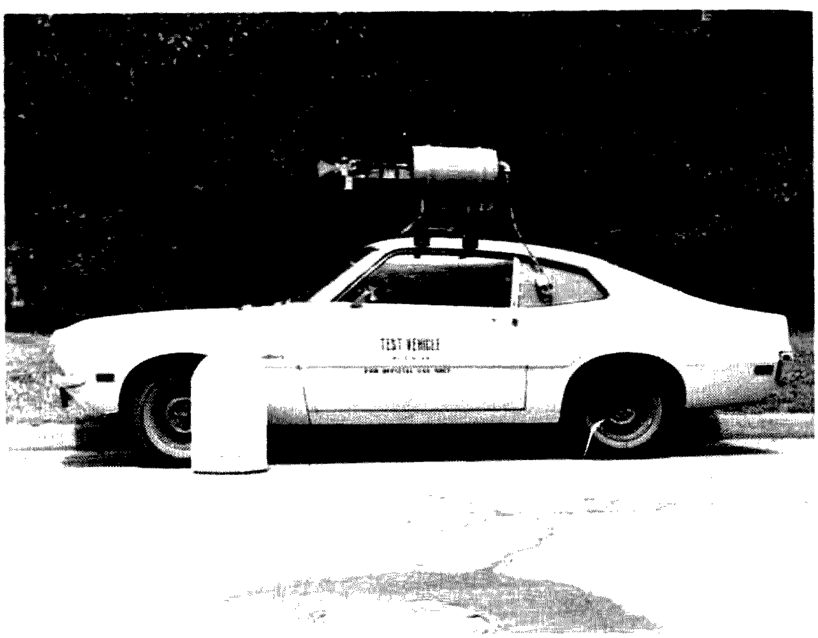
Clubs may lease the 220 MHz repeater at a monthly rental of $25.00 for 3 years with the purchase of 12 FM-21 220 MHz transceivers. Clubs will then have the right to fully pruchase the repeater at $500 at the end of the first year, at $300 after the second year, and at $100 at the end of the third year. Or secondly, a club may lease the repeater at a monthly rental of only $15 for 3 years with the purchase of 35 FM-21 transceivers.

Clubs would then have full purchase rights at $500 at the conclusion of the first year, at $300 after the second year, and at $100 at the end of 3 years.

The third option available simply enables clubs to buy the repeater for $1,000 with the purchase of 12 or more FM-21 sets.

The repeater is leased complete (except antennae and feed line) with features that include automatic identification, all solid-state construction, and built-in timers. It operates at 10 to 15 watts, uses a Phelps-Dodge duplexer, and has approximately .4μ V sensitivity. It includes an ac supply, local MIC, and metered signal strength.

All amateur radio clubs are invited to contact the Clegg Division or any Clegg Dealer if interested in joining or finding out more about the updated Clegg repeater program. Or, they may write Carl Jacobson, National Sales Manager, Clegg Division, International Signal and Control Corporation, 3050 Hempland Road, Lancaster PA 17601, or telephone him at (717)299-3671.



Here is a photograph of the 3cm mobile amateur rig presently being operated by WA4WDL. It has receivers for 10cm and 3cm along with a solid state transmitter for 3cm. It has a doppler radar system for anti-collission research and has the capability of legally confusing police radar units!

MINIATURE LICENSE COPIES

In an effort to encourage people to get the AMATEUR EXTRA CLASS license and to reqard those who have gone to the trouble to get the license, a Chicago organization has decided to give free, without any charge, an exact photostatic miniature wallet of an Amateur Extra license to those sending in their original.

Upon receipt of the original, the duplicate will be made and returned along with the unharmed original within about a week. It is asked only that a self-addressed stamped envelope be included for return of the original and the wallet duplicate.

Amateur Extras *only* should send their license and self addressed envelope to: *DUPLICATE – Amateur Extra 1701 W. Devon, Box 60045, Chicago IL 60660.*

News Pages

Twenty-nine more amateurs licensed in Jordan! Twenty-three boys and six girls have passed the one hundred hour study course and gotten their amateur licenses. The call for the club station is JY6AC — keep an ear peeled for them.

JORDAN'S TOURIST AND VISITOR CALLS

JY Call	Home Call	Name
JY8AA	W2NDS/1	Wayne Green
JY8AP	DJ0AP	Majdi Kurdiah
JY8BI	DK2BI	Joachim Immelnkempe
JY8JK	G3KP	John Ray Killeen
JY8MBB	MP4MBB	John Murdoch Cooper
JY9AA	WA3HUP	Mary Ann Crider
JY9AB	W3GE	Charles Crider
JY9AC	EP2JH-XYL	Karla Holmes
JY9AL	9K2AL	Mohamad Z. Ageel
JY9AM	9K2AM	Johamad S. Bahbahani
JY9BB	W4TA	Bruce B. Blackburn
JY9DB	WA2ADB	William C. Blackley
JY9DC	WB6CYZ	Gerald Holmes
JY9DK	WA6FSC	Darleen A. Souligny
JY9DX	WA5VKJ	Richard Harris
JY9FB	EP2FB	William Frisbie
JY9FI	OD5FI	Rachid Edriss
JY9FOC	G3FNF	Raymond Hargreaves
JY9GR	DJ9GR	Ruediger Geissler
JY9HF	7Z3AB	Henry Folkerts
JY9HM	FL8HM	Hassan Ahmad
JY9KS	WA2KBZ	Karl Shulte
JY9MA	SU1MA	Abdul Moety Attiya
JY9PP	DJ9PP	Karl Bauer
JY9SA	ST2SA	Dr. Sid Ibrahim
JY9VO	WA6OPJ	George Murray
JY9WB	EP2WB	Wolfgang Bauer
JY9XL	FG7XL	J. Pierre Tendron
JY9YL	EP2YL	Roselyn Frisbie

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	
Technician Class	50.100 – 54.000, 145.000 148.000, 220 MHz band and abcve.	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$9
Renewal	$9
New Class	$9
Modification	$4
Special Call Sign	$25

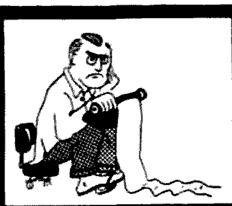
Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

RECIPROCAL LICENSING Between U.S. and: CE - CP - CT1 - CX - D - EI - F - G - HB9 - HC - HI - HK - HP - HR - LA - LX - OA - OH - PA - PY - SM - TG - TI - VE - VR2 - VU - YB - YN - YS - YV - ZL - ZP - 3A - 4X - 6Y - 8P - 9K - 9L - 9Y.

THIRD PARTY AGREEMENTS Between U.S. and: CE - CM - CO - CP - CX - EL - HC - HH - HI - HK - HR - JY - LU - OA - PY - TG - TI - VE - VO - XE - XP - YN - YS - YV - ZP - 4X - 4Z - 8R - 9Y. Also W/K/8P.

RESTRICTED COUNTRIES (don't work) are now down to only Vietnam(s) 3W8 and XV, with the exception of XV5AC being okay.



NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

PR TO CONGRESS

It may be of interest to amateurs who want to help their hobby that most, if not all, of the recent repeater licenses granted by the FCC have been as a result of congressional prodding. A call from a Representative or a Senator seems to break through the Walker quagmire of paperwork and red tape, where nothing else does.

One result of this mess is that there are now few members of congress who are not a little more familiar with amateur radio than they were a year ago. We want them to be even more familiar because we may need their help in getting the Walkerules repealed. To this end we here at 73 have prepared a short paper which explains what amateur radio is, what repeaters are, what our basic problems are, and how congressmen can help. Please send a sase to 73 Magazine, Peterborough NH 03458 and ask for the Congress Paper (two sheets). Send this to your senator or representative with a note asking him to help.


RADIO AMATEURS PLEAD FOR HELP !

WHY AMATEURS NEED HELP

The recent devestating fire in Chelsea (Boston) brought out a problem that needs some thought. Virtually all of the communications for the fire were carried on over two meter repeaters, with more than one hundred local amateurs participating. This is the stuff that we need to feed to the news media and to congress.

So what happened? The only story written about the event was sent to ARRL where, presumably, it will eventually end up in QST. Okay, so amateurs will know how great amateur radio is – but congress won't. The fact is that *only* 73 sends copies of its newspages to congress. Right now we need that PR with congress a lot more than we need it for self–congratulation. If you or your club gets involved in anything which reflects to the benefit of amateur radio, please see that it is written up – pictures taken – and send it to 73 Magazine. This goes for small services as well as large – saving one life or thousands.

By the way, the CBers tried to jam in around the Chelsea holocast, but had to be chased away since they had no clear channels and no discipline. By a curious quirk, all of the National Guard radios were out being serviced, so even they had to depend upon our repeaters.

Let's not continue to hide our light under a bushel – and let's stop depending on QST for PR – only 73 is doing amateur PR with congress.

EMERGING NATIONS

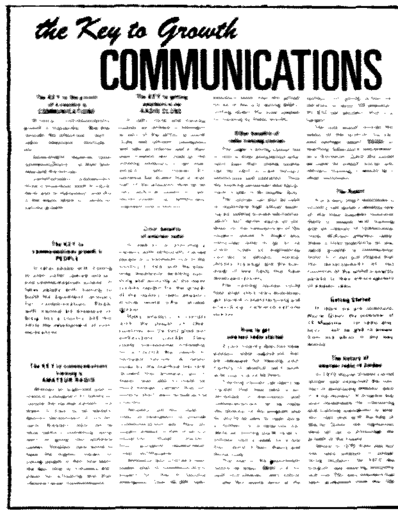
The future of our short wave and UHF bands lies more with the ITU than anything else, the current 224 MHz CB proposal notwithstanding. This, in turn, means that the very existance of amateur radio in the future depends upon the value placed on it by the governments of the African and Asian countries – the so-called emerging nations.

Is anything much being done today to prepare for the inevitable ITU conference scheduled for the 1970's? The answer, unfortunately, is that very, very little is being done.

One of the keys to getting support from these countries is to get them involved with amateur radio. The hobby has enormous benefits for any country, if only the leaders knew about it. The problem is, then, how do we get the word to them?

While not all of us know the leader of a country personally, there are more amateurs than you might think that do get to talk with them now and then – one approach would be to make sure that no such opportunity is missed. If you talk with an amateur who has such a connection, make sure that he realizes the importance of trying to get amateur radio developed in the country.

In order to help this project, we have prepared a paper which explains the benefits of amateur radio to emerging nations, ending with the example of Jordan and the developments there. Copies of the paper may be had by sending a sase to 73 Magazine, Peterborough NH 03458 and asking for the "Key to Communications" paper.


the Key to Growth

COMMUNICATIONS

If you even know an amateur who may be visiting a small country and who might be able to get to see the president or king, see if you can have a copy of our paper in his hand when he leaves. You might also ask amateurs in the rarer countries if such a paper could be gotten to an appropriate level if you sent one over. Let's get to work on this and start laying the foundation for the continuance of amateur radio into the 80's. You might also be responsible for hundreds or even thousands of new hams sprouting up in some corner of the world, thus having a lasting effect on their lives and the future of their country.

POSITIONS OPENING

As 73 Magazine continues to grow, there are more positions opening on the staff. The work is fun and the work atmosphere perhaps a little more relaxed than it ought to be – and there is no finer place to live in the country than New Hampshire – an area famous for vacationing four seasons of the year.

Our needs are changing constantly, but at present we are looking for help in editing, circulation and advertising sales. Salaries are generally in the $6000 to $9000 range, but his depends upon experience. Some writing or photography experience will be helpful, and the more ham experience the better.

Continued on page 17. . .

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

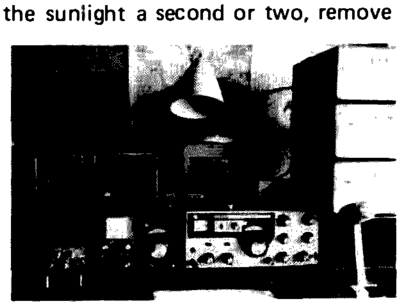
The Slow Scan Program Contest which we announced in October to run through December 31, 1973 is in full swing and progressing quite well. There's no "wallpaper" being awarded, but I'm sure you could find a prominent place for that gear, eh? Recapping briefly, this is a contest for the best SSTV program received. (Use 1 7/8 ips cassettes. . .6 minute maximum time limit on program.) Entries will be judged on originality of the SSTV program, with technical aspects counting in the scoring. If you haven't sent in your entry yet, do get busy and give it a try – turn that skill and ingenuity into some SSTV gear. Be sure to include return postage for the cassette and get it in the mail to 73 Magazine, Peterborough, New Hampshire 03458 so we will receive it by December 31. Results will be announced in this column and maybe on the SSTV net the first of January.

VK9XX of Christmas Island and KG6KA of Guam are now active on 20 meter Slow Scan, and VK9DJ on Papua is set to go except for a crt, which he should have by the time you read this. 3D2AZ and 3D2BJ on Fiji have the "SSTV bug" (thanks to some help from Barry, VK5BS) and we hope to get them going, even if on loaned gear. I understand Fiji is a real paradise and natives there don't get in a big hurry over life, (Gad! Do places like that still exist?) so it may be a few months yet. . .Down Australia way, VK6ES now has a vicicon camera going, and VK7CD has finished his WØLMD Monitor, while some of the other VKs are now starting construction of a WØLMD unit. They also report growing JA Slow Scan activity as does Bob WA7QBV, who passed along this month's photo he received from JAØBZC. Fine looking gear.

I often receive inquiries from Slow Scan newcomers about the various SSTV nets, and their operating procedure. There are 3 basic world wide nets: the U.S. Net, which meets on 14.230 khz at 1800 gmt every Saturday, the Australian SSTV Net, which meets on 14.230 khz at 0100 gmt Sundays, and the Canadian SSTV Net, which meets on 14.180 khz at 2100 gmt Sundays. All three nets use relatively the same procedure, so I will exemplify the U.S. Net. A specific area is called for, (like Eastern United States, or Western United States area) and you call in with a short call on SSB only. The net control will acknowledge each station, then, in turn, call for each to transmit. Your transmission should begin on SSB with the usual name, QTH bit followed by any questions, request or items of interest you have. Then a brief Slow Scan TV transmission from you and back to net control. (Remember this is an example only, not a sterotyped form.) Should you, during the course of the net, hear something or someone of interest, there is a time you can call back in. Usually the net control makes this obvious with something like "any comments on the previous transmission by. . ." Often conversations on or near the net become quite technically involved, and much information (and new ideas!) is exchanged. Here you must remember Slow Scan is the newest and most sophisticated mode today and advancements are happening so fast often even the magazines can't keep abreast. In fact, most of the net controls are set up for I.S.B. and I suspect we will soon see more of this on the net also.

While on the subject of newcomers, here's a couple of "Rambling thoughts" worth mentioning. . .SSB DXers can usually spot DX by the wavering audio and speech accent. Slow Scan TV DX (which syncs from 50 Hertz lines) is obvious to the ear because their sync pulses are running slightly faster, and while viewed on the screen their pictures are not as wide. The next time you see DX pictures, make a mental note of these points, compare them with U.S. pictures (60hz line frequency) and you'll see what I mean.

A while back, I mentioned the fact various P7 crts had different degrees of persistance (some far too short for Slow Scan TV) and, as a result, many of the fellows considered using only RCA tubes as an alternative. But what about those "hamfest specials" one invariably runs into? One quick way you could check their persistance is to hold a quick-made transparency (sketch on cellophane paper with a felt pen) over the screen, expose to the sunlight a second or two, remove the slide, then view iin a dark area, or cover crt face with hands, etc. Make sure your eyes are accustomed to dim light while checking the persistance. In a pinch, you could just lay a couple of fingers on the crt face for the "slide" effect. A good P7 crt will hold an image like this the same as if it were a regular Slow Scan picture.



Shack layout of JAØBZC. The SSTV gear at the left and all the other equipment besides the FT-200 is homebrew.

Finally, Franco I1LCF and CQ Elettronica of Italy are presently conducting two contests: one for the best quality pictures exchanged over the air on SSTV and the other for the longest distance covered by SSTV. Send photos and/or tapes to Franco, I1LCF. Sorry, I don't know the deadline or prizes yet.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

WB2LGD says August was poor except for the 10th, worked Alabama, Florida, Mississippi, Ohio and Cal fornia from 13/30 to 17/30Z. Bob and Mike W2FND attended the East Coast VHF Society antenna measuring contest in Trenton, N.J., returned to Mike's QTH and worked 8P6EN. Bob went to his home, turned on the rig and worked WA7FSI/7 in Idaho. . .and is still wondering what he missed.

WA1EXN notes 6 days of skip in August, September contest poor until Aurora at 1900Z. Worked 2–3–4–8–9–VE2–3 on SSB until 2300Z, then worked another hour on CW after SSB faded. Art's comment on SB–110 noise limiter capacitor change (to 200pf) "all I can say is beautiful." Art also says a 12GN7A makes a good substitute for 12BY7s. No more output but a lot more stable and lasts a lot longer.

WØYZS told me at the Central States VHF conference in Bloomington, Minnesota that he expected to have the antenna back up within 2 months – have not heard him yet. Andy VE4MA is moving to VE6 with his 50MHz gear, son Barry will remain active as VE4MA but only on the higher frequencies. It was a pleasure to meet W7JRG and W7VDZ after years of talking to them, also enjoyed several hours conversation with KØLCB, K5WVX and K5BXG while mobiling from Minneapolis into Iowa. WØPFP commented that we had not talked on the air for several years so we made up for lost time in the Marriott bar and managed some fur-

ther comments via Aurora during the contest.

Mac WØGNS attended to lend an air of respectability to the proceedings as did KØRIR, WA7FPO and W1HDQ. Ed presented a slide program featuring the VHF triumphs of the 40's and 50's. Dick K2RIW presented a most interesting talk on external anode amplifier design, while Mel W2BOC treated us to the fruits of his labors in documenting Es over the past several decades. Hoppy WB4BND was in attendance wearing a "73" button and chewing his ever present seegar. Hope to see you in Colorado next August.

I attended a meeting of the Amateur Radio Technical Society of St. Louis last spring during which it was suggested that perhaps readers of this column would be interested in a ground plane designed and used by club members. By minor adjustment of dimensions this antenna could be used in the SSB, AM and FM portions of the band and best of all, the parts are inexpensive and readily available.

WAØABI

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

DEC 1–3	Delaware QSO Party
DEC 15–16	EA (Spanish) Contest CW
FEB 9–10	Ten–Ten International Net Contest

THIS MONTH

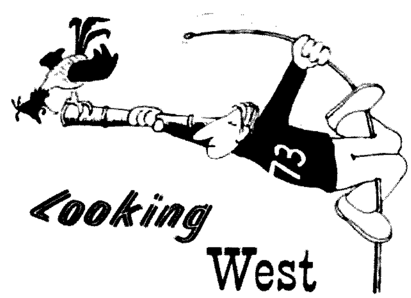
Delaware QSO Party

From 0000Z DEC 1 to 0000Z DEC 3. Stations may be worked only once per band regardless of mode. Exchange QSO nr., RS/T and QTH (DE county or state/province/country.) Freqs.: 3560, 7060, 14060, 21060, 28160, 3975, 7275, 14325, 28650, 50.4, 145.2, 21120, 28160. DE stns. score 1pt. per QSO and multiply by nr. states/provs./cntrys. Non-DE stns. score 5pts. per DE QSO and multiply by 1 for 1 DE county, by 3 for 2 Counties, and by 5 for 3 counties (New Castle, Kent, and Susses). Appropriate awards. Mail logs with SASE if award & results desired to John R. Low K3YHR before JAN 15, 1973. ADR is 11 Scottfield Drive, Newark DE 19711.

EA (Spanish) Contest CW

From DEC 15 at 2000Z to DEC 16 at 2000Z. Send six digit QSO and RST combination (eg. 599001, 579002 etc.). US stns. score 2 pts. per QSO with EA District stns. US stns. multiply total QSO pts. from each band by total EA Districts worked from each band. Logs should include dates, times, bands, stations worked, exchanges sent & recieved, QSO pts. and new mulitpliers. A summary sheet is also required with point info & declaration etc. These must be received by JAN 16 and the ADR is URE 1973 International Contest, P.O. Box 220, Madrid, Spain. If you can read Spanish better than I can, write them for complete details.

WB8KZD



Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

What has become of Larry? You know, "CB Larry", the menace of New Mexico. Larry is the heaxter who popped up on 11 meters one day yelling for help. He claimed he was trapped in an overturned vehicle some place in the Monzano Mountains southeast of Albuquerque. Immediately, some 200 rescuers and 22 search planes were organized and a thorough search of the area was begun. As reported in Newsweek of September 10, 1973 (Page 53, titled "Blabbermouths") the search lasted five days but failed to turn up any trace of the distress caller. The network media covered the event from start to finsih while the country waited for word of a rescue. It was a hoax! An expensive hoax if you consider what the rescue effort probably cost the taxpayer.

The story does not end there. Not content with his original escapade, he re–appeared on 11 meters again, this time to take credit for his original deed. As if that were not enough, according to Newsweek the language he used at that time was the type that might make the proverbial sailor blush. So far he has gotten away with it. This incident has finally brought the problem of the mess on 11 meters to the eye of the American public. While we in amateur radio have known of the CB problem for years and have tried in vain to get the FCC to do something about it, now the situation has reached just about every livingroom in the country. Incidents such as these point out dramatically why the Citizens Radio Service should not ever be permitted to expand, especially into the amateur bands. If they cannot police themselves, and the FCC is not willing to do so on a large national scale, then the service is totally useless and should be phased out as soon as possible. I strongly recommend that every amateur acquire a copy of the afore mentioned Newsweek article and read it. It's an excellent journalistic effort and worthy of commendation. As for "Larry", well we can only hope that he will be caught and punished.

I have spent a lot of time in New Mexico in the past few years and have a number of friends living there. My wife Sharon and I spent part of our honeymoon there and we again visited the Albuquerque area while en–route to California last year. Though there are a number of repeaters in the area, the only one I had rocks for was WA5JDZ located west of the city atop Mt. Taylor. This is an open .34/.94 machine with possibly the most distinctive identifier I have ever heard. It is also one of the friendliest repeaters I have ever come across and the amateurs that operate it went out of their way to make our five days in the "Duke City" an event we will find it hard to forget. The repeater covers the area along I–40 quite well from about 70 miles east of Albuquerque and we were still hearing it on our IC–2F when we approached the Arizona border. With a 10,000 foot mountain under your machine you can cover a lot of miles. Since I am planning to expand LW to encompass the entire Southwestern United States, I would enjoy hearing from the Albuquerque group and any other repeater people in the area.

Back home in LA, I had the honor to be invited for a tour of the brand new L.A. County Sherrif's Communications Center, a good part of which is devoted to amateur radio. While many cities have abandoned or shelved amateur radio as a communications system, Los Angeles has taken just the opposite view. They realize the value of a well organized RACES communications network and its value in time of emergency and have backed up their opinion with facilities and equipment to implement the system. My guides, Lou Scherer WB6OON and Sgt. Frank Oakden spent quite a bit of time explaining the new system and

73 magazine's 1st Annual

RULES:

- 6 minute maximum time length
- Subject matter is limited only to your imagination – anything goes.
- Label cassette with your return address and include sufficient return postage. All programs will be returned.
- Decisions of the judges will be final.
- Contest starts now – entries must be mailed before December 31, 1973.

First Prize

ROBOT Model 61
Fast Scan Viewfinder
Other prizes to be announced.

Send your entry to: Slow Scan Contest, 73 Magazine, Peterborough, NH 03458.

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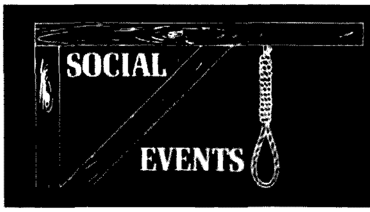
asked if I would mention that they are looking for recruits, some 5,000 of them! If you are an amateur of Technician class or higher, and live in any area served by the LA County Sheriff's Department, this might interest you. Contact the LA County Sheriff's Department for more information.

L.W. wishes to congratulate Walter Braunstein W6EJK on his election to the Presidency of the Pallisades A.R.C. of Culver City. They are without a doubt the most active amateur club in Southern California, and have found many ways of involving amateur radio in their daily lives. Their repeater WR6ABB was set up as thier club station, available to all members at all times. I received the honor of being asked by Walt to become co–chairman of the club TVI committee, along with Martin Geisler WA6TIC who has done quite a job in that position for a long time. If I come up with any interesting cases or cures, I'll be glad to pass them along.

Since the holiday season will soon be upon us, Sharon and I wish to take this opportunity to wish you all the best of holiday wishes and we will be seeing you in the New Year.

WA2HVK/6



FORT WAYNE HAMFEST

A Hamfest will be held in Ft. Wayne IN on 13 January, 1974 at Shiloh Hall on Carroll Road, west of IN-3; flea market – food – 807's – softies. $1 in advance – $1.50 at the door. Tables – 4 feet $1.

For info write: A.C. Arts, PO Box 342, Ft. Wayne IN 46801. Talk in 94/28 – 88/52. Electronics equipment only please.

KITTY HAM

December 17th, 1973 marks the 70th anniversary of the first powered flight which the Wright brothers made at Kitty Hawk, North Carolina.

The Raleigh Amateur Radio Society and amateurs from the Kitty Hawk area will operate special event station KH4NC at Kill Devil Hill which was the site of the historic flight.

Operation of the special event station is in commemoration of that first powered flight by the Wright brothers which marked the birth of modern day aviation.

Proposed operations will be conducted from ØØØØ GMT, 15 December through 24ØØ GMT, 17 December 1973. Frequencies to be used will be 3530, 7030, 14030, 21030 and 28030 kHz - CW, and 3910, 7210, 14280, 21355, and 28505 kHz phone. Note that these frequencies are approximate and amateurs should listen on these frequencies plus or minus 10 kHz. Some operating time will be devoted to the novice class sections of the above bands. In addition to these operations, an Oscar satellite ground station will be set up for possible contacts through Oscar 6.

A special commemorative QSL card will be available to stations contacting KH4NC, SASE please, via K4CIA, PO Box 17124, Raleigh NC 27609.

MN HAMFEST

The winter PICONET-HANDI-HAM hamfest will be held Saturday December First 1973 at the Eagles Club in Fairbault MN. There will be a dinner, program and prize drawing. Registration starts at 9AM. Contact Don Franz WØFIT, Secretary-Treasurer PICONET, 1114 Frank Ave., Albert Lea MN 56007.

DX FOOTNOTES

Gus Browning W4BPD
Drawer "DX"
Cordova, SC 29039

DX is back with us again, here it is wintertime and the bands are full of some mighty good DX again. Better get in there and join in on the fun. According to one of the propagation predictions editors of one of the magazines the sun spot cycle may pass through its minimum some time this winter. I am sure we all hope he is correct in his "prediction" It's pretty tough sledding when those sun spots are at a very low count.

W3AG has moved over to Greece and it looks like he will be there from "now on" and (get this) he lives only about 25 or so miles from the border of Mt. Athos ! It seems it's easier to get a Mt. Athos license than a SV license, because he is now on the air in Mt. Athos with the call SY5MA and is working the boys, especially a lot on CW. In case some of his old buddies want to drop him a line over there, here is his address (in Greece);

Willard Hunton,
c/o Mrs. Loch, The Tower,
Ouranoupolis, Greece

Willard tells me in a letter that he will hang out around the portions of the bands where Generals or anyone else can work him. His QSL manager is W4KA, and Willard will send his logs back every two weeks so the QSL cards will go out pronto.

Anticipated hours of operation will be: 0600-0800; 1000-1200; & 1400-1600 GMT. Will also use the low end around 14010, 21010 etc. (ed.-I predict Mt. Athos will shortly be removed from the rare country list).

There seems to me quite a bit of activity around the Indian Ocean with the fellows from the Seychelles going to some of the outlaying islands on DXpeditions. I suggest that those of you who need this area keep in touch with the gang in Mahe, Seychelles. They can tell you of their future plans. We all hope they continue to do this. My only regret is that I am not with them, sure would be nice to see those beautiful islands again.

Have just about got a new country list made up for our WTW. By counting the places various National Associations counts the new total will be something around 375 to 400 or so. You had better start looking real close at all those Russian cards, a number of them will be added to our list, also quite a new more under FO8, and still a few more, here and there. A SUPER WTW ? ! Am considering a new award that will be called the "SUPER WTW" ! Am not sure yet that the "Boss Man" (Wayne Green) will go along on this or not. The idea of this award is to have "lots" of DX areas on the list, almost any island (even Catalina, Long Island, etc. and count even every state in the USA, every province in Canada, every-Helvetta in Switzerland, every district (licensing district) in South Africa, every district in Australia, etc. etc. You could really say that you have Worked The World if you were the Top Man on the Super WTW Honor Roll! We would start an Honor Roll each month for "our" Super WTW. I would think such an award would be an award to stop all other awards! How does that strike you fellows who want "real activity" on our bands? Am sure I will hear from the gang on on this! I can just hear 'em now,saying that crazy fool, Gus is about ready for the Bug House and a strait jacket!

Our WWDXA (World Wide DX Association) is coming along very FB. At the time of writing this the membership is getting up near 50 I would guess, and growing each day. Every $ 6.00 yearly membership fee has been put in the bank and as long as I can stand it, will continue to be put there to be used only for the betterment of DX when the occasion arises. Before we start tapping this account we want a very sizeable amount in the bank first. You can be sure the "occasion" will have to be a good one.

I have often wondered why a small low powered rig with a very makeshift antenna with a high SWR will Work The World with very nice signal reports from a DX spot and the very same rig back "home" will not even get a CQ answered ? I guess it's that 20db "added" signal report you have when you are DX, the rarer the spot the more db's your signal will have, or it certainly seems like to me, but, every time I think of low power I think of Howie, W2QHH and all the awards and certificates that he has earned. Howie is not in a rare state. (N.Y. State is not rare to anyone). W2 is not a rare call area, Howie was letter carrier (mail man) when he got most of those FB awards which means that he could not "sneak" home to get a new one when it showed, all this and usually only a dipole or long wire (actually you and I would call it a short, long wire), and he lived in a (and still lives there as far as I know) small New York village in a sort of valley. His power has never exceeded 75 watts, usually was around 35 watts, I even worked him from AC3PT ! (he was RST 339 on 21 mc CW). To me this only goes to prove that you can "do it" on low power, but a lot of good friends and some letters undoubtly helps a bit too, and a lot of good down to earth planning and being "very persistant" for that new one. I guess in the end its the operator more than anything else that gets the results. Anyway, my hat is off to him. Howie may have done it the hard way, BUT, he got the job done, and how !

We are still in need of some radio clubs in various parts of the country to act as verification points for the WTW award. If your club is interested in this small task drop me a line and lets get together. Your club will get a little publicity when we list our verification points occasionally in this magazine, very little actual work involved. How about your club joining up with us on this little project ?

Have attended quite a few conventions around the country this year and all the fellows want more and better DX on the air, they would like to have more "professional" DX operators on the other end of the pile-ups and if possible more activity when the DX station actually gets on the air from the rare spots and when it's all over a "speedy" QSL would make the hunt a very FB success to the whole thing. Without that all important QSL card for verification purposes the whole chase becomes more or less useless.

If any of you happen to know of a DX station that is looking for a Stateside QSL manager let me know because I usually have a number of stateside hams who would like to be a QSL manager for DX stations (ed.-they can have that job and all the hard work that is involved).

It is with deep regret to announce the death of W3GHD, Bob Wilson on September 9th after being in the hospital only 3 days. Death was the result of a stroke Bob suffered.

The DX world has lost one of it's great operators and a very active ham. Bob was a personal friend of your editor and will be missed by all.

Understand that Wayne went to the hospital for examination, sure hope it's nothing serious and is back on the job again by now.

SAY GANG, some of the applicants for both WTW and 73-73-73 award is not sending the $ 1.00 fee. This slows things down, so, how about remember this fellows and save me time and work ? Many Thanks.

73 es DX, CU next month, de Gus BPD

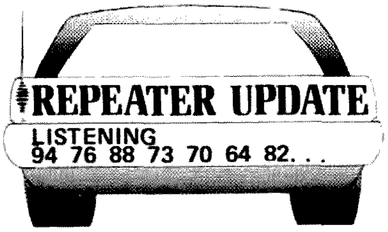
73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				EQUIPMENT
		Hz				
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS



AZ	WR7ABQ	Phoenix		146.34-146.94
				146.16-146.78
AZ	WR7ABR	Phoenix		146.04-146.64
AZ	WR7ABS	Phoenix		449.3-445.3
AZ	WR7ABT	Phoenix		146.22-146.82
CA	WR6ACF	San Diego		146.04-146.64
CA	WR6ACA	L.A.	RTTY	148.18-146.70
CA	WR6ABT	West L.A.		Closed
CA	WR8ACD	L.A.		146.22-146.82
CA	WR6ACJ	L.A.		146.25-146.85
CA	WR6ABO	L.A.		146.34-146.94
CA	WR8ABW	L.A.		Closed
CA	WR6ABI	L.A.		Closed
CA	WR6ABA	L.A.		147.81-147.21
CT	WR1ACD	Monroe		146.235-146.835
FL	WR4ACZ	Pensacola		146.16-148.76
GA	WR4ABN	Atlanta		147.83-147.03
GA	WR4ACX	Eatonton		146.10-146.70
IA	WRØACF	Ayrshire		146.22-146.82
ID	WR7ABX	Moscow Mtn.		146.22-146.82
IL	WR9ABY	Chicago		146.16-146.76
				448.75-443.75
IN	WR9ACG	Plymouth		146.07-146.67
KS	WRØABZ	Winfield		146.16-146.76
MA	WR1ABX	Holyoke		146.34-146.94
MA	WR1ABY	Maynard		147.84-147.24
MA	WR1ACB	Bellingham		146.46-147.06
NC	WR4ADN	Elizabeth City		146.28-146.88
NY	WR2ACB	Long Island		146.16-146.76
NY	WR2ACI	Valhalla		147.66-147.06
NY	WR2ACK	Gloversville		146.16-146.76
TN	WR4ADF	Knoxville		52.76-52.525
				146.34-146.94
				449.3-444.3
TN	WR4ADO	Kingsport		146.16-146.76
TX	WR5ACF	Lufkin		146.34-146.94
VT	WR1ACA	Mt. Ascutney		146.16-146.78
WA	WR7ABZ	Yakima		146.34-146.94
WI	WR9ABF	Milwaukee	PL	52.80-52.525
			PL	147.99-147.39
				449.5-444.5
				1250.0-1220.0

INTRUDER CHASE

Jonathan Tara WB8DBN
16260 Greenfield
Detroit MI 48235

Contrary to popular opinion, there are several things you personally can do to rid our bands of intruders. If you wait for someone else to do it, their numbers will just continue to mount.

First off, you can write a letter to the offending station. Don't laugh, it works – sometimes. You may think that the station obviously knows that it is operating illegally and that your letter will wind up in the proverbial circular file. On the contrary, the station is not technically in violation of international regulations until it has been told that it is causing interference. It may be obvious to you that a megawatt on 7250 beamed to North America is going to cause trouble, but the broadcast station will take full advantage of this technicality. The truth is that these stations seldom get complaints. You may be surprised and get immediate satisfaction – the BBC agreed to reduce the level of their 20 meter second harmonic by 6dB in response to a letter from me. In other cases it may be slower – Radio Moscow invited me to send them tapes showing interference caused by their transmissions. ("We shall be glad to receive a cassette tape recording. . .please make it 7 1/2 i.p.s.")

Keep the technicalities of the international regulations in mind when you write the letter. You won't get anywhere by accusing the station of operating illegally. The thrust of your letter should be to inform them that they are causing interference to hams with their transmissions. It doesn't hurt to mention that they *will* be in violation of international regulations if they continue. This way they know that you *are familiar* with the regulations, so they have to be more careful in answering you.

Be sure to give full details of the transmission, and include a tape if possible. Check the address of the

FCC MONITORING STATIONS

Address your report or complaint to "Engineer in Charge, Federal Communications Commission, (name of city) Monitoring Station,"at the various addresses given below, listed alphabetically by city or town. The telephone number for each monitoring station is also listed.

P.O. Box 89
Allegan MI 40901
(616-673-2063)

P.O. Box 1126
Denison TX 75020
(Ambrose Monitoring Station)
(214-965-7729)

P.O. Box 6303 Annex
Anchorage AK 99502
(344-1011)

P.O. Box 470
Belfast ME 04915
(207-338-4088)

P.O. Box 374
Canandaigua NY 14424
(315-394-4240)

P.O. Box 251
Chillicothe OH 45601
(614-775-6523)

P.O. Box 6
Douglas AZ 85607
(602-364-2133)

9900 West State Road 84
P.O. Box 22836
Fort Lauderdale FL 33315
(305-583-2511)

P.O. Box 1588
Grand Island NE 68801
(308-382-4296)

P.O. Box 632
Kingsville TX 78363
(512-592-2531)

P.O. Box 40
Laurel MD 20810
(301-725-3474)

P.O. Box 311
Livermore CA 94550
(415-447-3614)

3222 McLeod Road
P.O. Box 339
Bellingham WA 98225
(Marietta Monitoring Station)
(206-734-4196)

3600 Hiram-Lithia Spring Road, S.W.
P.O. Box 85
Powder Springs GA 30073
(404-943-5420)

P.O. Box 181
Sabana Seca Puerto Rico 00749
(809-784-3772)

P.O. Box 5126
Santa Ana CA 92704
(714-545-1333)

P.O. Box 191
Spokane WA 99210
(509-244-2141)

P.O. Box 1035
Waipahu HI 96797
(808-677-3954)

station in the World Radio TV Handbook, which will also give you the name of the Chief Engineer. If you can't get your hands on one, drop me a line.

If a local broadcast station is the offender (harmonics) you might try a phone call to the Chief Engineer. He'll probably be happy to have the problem brought to his attention before the FCC finds out.

Next, you might try the FCC. I have found them to be of little use, but you may find them helpful. One thing they are good for (if you can afford to call the nearest monitoring station) is to get bearings on an unknown station. Unfortunately, all monitoring stations are not operated 24 hours, and it may be difficult to get a bearing. For example, I called the Allegan, Michigan station to check on a commercial RTTY station on 40 meters. Since they only had a station in Florida to work with, the best they could tell me was "the West Coast of South America."

The FCC will take your name and call, and supposedly you will get some word from them as to what happened to your report. However, I have never received any such confirmation. I get the impression from talking to them that they are busy with other things, and really don't want to spend the time.

And finally, you can complain to Intruder Chase. This will be described in full next month, but basically it will serve to validate reports to make sure that the offending stations get accurate information and to coordinate reports. This way a station can't send out letters to a hundred people telling each of them that theirs was the only complaint received. The Intruder Net will keep interested people more closely informed on the current situation, as well as being invaluable for direction finding. I should have a couple of direction finding antennas for 40 ready soon, either to be described in a future column or for an sase.

By the way, the Chase is not trying to compete with the ARRL Intruder Watch, but is in *addition to it*. All reports to the Chase will also be forwarded to the ARRL. We will try every avenue available to get rid of the intruders.

There is no intruder listing for this month, since I haven't gotten any reports yet due to the publishing delay.

. . . WB8DBN

AMSAT NEWS

OSCAR 6

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

AMSAT's activity during the next year is expected to continue to focus on the OSCAR 6 and A–O–B satellite projects. Concurrently with this activity, AMSAT is exploring with WIA–Project Australis and AMSAT Deutschland; the development of new satellites to be constructed by these groups using some AMSAT–provided A–O–B series hardware, along with new communications repeater experiments. Additional projects showing excellent progress toward use for future OSCAR satellites include a new spaceframe structure under development by Project OSCAR, Inc. in california and 144–to–435 MHz linear repeaters under development in Germany and Australia.

In addition to technical activities, efforts are now underway to secure funds for continued AMSAT projects, directed not only toward providing more advanced satellites of the A–O–B series, but also toward developing the capability of building AMSAT payloads for synchronous, near–synchronous and synchronous–transfer orbits. The funding for these projects, estimated to require nearly $100,000 per year, will necessitate additional donations from individuals, as well as contributions from other sources. Assisting with the fund–raising efforts will be the new ARRL Foundation recently established by the League Board of Directors. One of the first functions of this foundation will be to obtain donations for satellite projects. The directions future projects take and the overall level of AMSAT activity in the years to come will be dependent upon the degree of financial support obtained by the new foundation.

WB1DNW has reported seeing OSCAR 6 thru his telescope at the Talcott Mountain Science Center. After many nights of careful planning along with the waiting for a clear sky Bob was rewarded with the satellite showing up as a small white dot in the sky. It's no small task to find a tiny object less than a yard across at a distance of 115 miles. But as Bob has proved it is far from impossible.

The ARRL is sponsoring a 10 meter contest on December 15 and 16 to

promote activity on this band. The news however is that they are allowing satellite contacts to count as points in the contest. Complete details are available from the League.

OSCAR 6 celebrated it's first birthday October 15. For the occassion AMSAT drafted a taped message which was broadcast over the satellite during the referance orbits for a week. The fact that Oscar 6 survived for this length of time is a boost to AMSAT and all the people who have helped around the world. It is also an indicator that future satellite's of an improved design can last for much longer periods of time.

December Orbital Information

REV	DATE	TIME Z	LONG W
5151	1	0046.6	59.3
5164	2	0141.6	73.0
5176	3	0041.5	58.0
5189	4	0136.4	71.8
5201	5	0036.4	56.7
5214	6	0131.3	70.5
5226	7	0031.2	55.5
5239	8	0126.2	69.2
5251	9	0026.1	54.2
5264	10	0121.0	67.9
5276	11	0020.9	52.9
5289	12	0115.9	66.6
5301	13	0015.8	51.6
5314	14	0110.7	65.3
5326	15	0010.7	50.3
5339	16	0105.6	64.1
5351	17	0005.5	49.0
5364	18	0100.5	62.8
5376	19	0000.4	47.8
5389	20	0055.3	61.5
5402	21	0150.3	75.2
5414	22	0050.2	60.2
5427	23	0145.1	73.9
5439	24	0045.1	58.9
5452	25	0140.0	72.7
5464	26	0039.9	57.7
5477	27	0134.9	71.4
5489	28	0034.8	56.4
5502	29	0129.7	70.1
5514	30	0029.7	55.1
5527	31	0124.6	68.8

Summary of AMSAT–OSCAR–B Spacecraft System

AMSAT Deutschland Repeater (designed by Karl Meinzer, DJ4ZC). Input frequency passband between 432.125 and 432.175 MHz. Out frequency passband between 145.975 and 145.925 MHz. Power output (high power mode) is 14W PEP. Downlink passband is inverted from uplink passband. Repeater is 45% efficient using envelope elimination and restoration technique. Linear Operation– SSB and CW are preferred modes. Repeater is commandable to either 3.75 or 14W PEP output. Telemetry beacon at 145.980 MHz (200 mW).

AMSAT Two–to–Ten Meter Repeater (designed by Perry Klein, K3JTE) Input freq. passband between 145.85 and 145.9 MHz. Output freq. passband between 29.40 and 29.50 MHz. Power output is 2W PEP. Downlink passband is not inverted from uplink passband. Linear Operation – SSB and CW are preferred modes. Telemetry beacon at 29.50 MHz (not same as OSCAR 6).

Morse Code Telemetry Encoder (designed by John Goode, W5CAY). 24 analog input channels. Converts each analog value into a two–digit Morse code number or "word." A third digit precedes the telemetry value and gives the line number in which the word is located. Format is arranged 4 words per line, six lines per telemetry frame. Morse code rate is commandable to 10 wpm or 20 wpm.

Teletype Telemetry Encoder (developed by Peter Hammer, VK3ZPI and Edwin Schoell, VK3BDS). 60 analog input channels. Converts each analog channel to a three–digit number transmitted in Baudot code. Each three–digit value is preceded by its channel number, making a five–digit telemetry word. The data is arranged 10 words per line by six lines per telemetry frame. Two lones of status information follow the analog matrix and give the spacecraft time (i.e., time in "counts" from launch, 1 count = 96 minutes). Output keys 435.1 MHz beacon in FSK: 850 Hz shift; 45.5 Baud: (reversed from U.S. standard). Also keys 145.98 and 29.50 MHz beacons as AFSK, on command.

435.1 MHz Beacon Transmitter (developed by Larry Kayser, VE3QB and Bob Pepper, VE2AO). Beacon output freq. is 435.10 MHz. Power output is 0.4W at an efficiency of 45%. Beacon is FSK modulated 850–Hz shift.

2304 MHz Small Beacon Transmitter (developed by San Bernadino Microwave Society). 0.1W at 2304 MHz. Turned on by command only for 30 min. periods. CW keyed – HI followed by 30 sec. carrier. Also keyed with Morse Code telemetry on command.

Codestore – Message store-and-forward system (built by John Goode, W5CAY). 896 bit memory capacity using COS/MOS shift register memory. Loaded via command link. Output code speed is 13 wpm.

Experiment Control Logic (designed by Jan King, W3GEY). Selects the spacecraft operating modes. Protects satellite against excessive battery drain by reducing repeater output power or by shutting it off completely.

Input Solar Power / Battery Charge Regulator (developed by Karl Meinzer, DJ4ZC and Werner Haas, DJ5KQ). Converts 6.4V at arrays to 14V to charge battery or to supply the spacecraft experiments. Senses overcharge of battery and reduces charging current. Senses failure of either of the two redundant regulators and switches to the opposite regulator automatically.

AMSAT–OSCAR–B Spacecraft

A–O–B (to be known as OSCAR 7 after launch) is an international effort now involving four nations. The A–O–B systems developed in each country are as follows:

Germany: AMSAT Deutschland Repeater, Spacecraft Structure, Battery Charge Regulator, 28V Power Regulator, Antenna System – DJ4ZC, DJ5KQ.

Australia: Two Redundant Command Decoders, Teletype Telemetry Encoder – VK3ZPI.

Canada: 435.1 MHz Beacon Transmitter – VE3QB and VE2AO.

United States: 2M/10M Repeater, Morse Code Telemetry Encoder, Experiment Control Logic, Instrumentation Switching Regulator, Solar Panels, Battery – K3JTE, W3GEY, WA4DGU, W3DTN, Marie Marr. Codestore – W5CAY. S-Band Beacon Transmitter – K6HIJ.

. . . WB8LBP

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

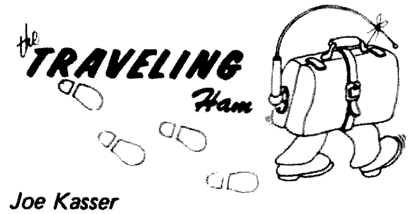
73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Robert White
366 Clinton River Dr.
Mt. Clemens MI 48043
468-4746

Allan Kowal
21-2800 Allwood St.
Abbotsford B.C. Canada
859-7928

John Diecker
9968 Northamton Dr.
St. Louis MO 63137
314-868-2905

James Taylor
1516 Sheley Rd.
Independence MO 64052
816-252-4844



Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring, MD 20910

A recent column briefly mentioned the value of mint or unused U.S. postage stamps as gifts for foreign hams when travelling overseas. They are useful to those avid dx-ers who wish to send QSL cards direct to stateside QSL managers so as to receive the QSL's by return mail (hopefully).

Well the same thing works in reverse. If, for example a stateside station works a station in Andorra with a QSL manager in Germany, a direct mail QSL would require three IRC's, costing about 60¢ to be used to purchase postage stamps costing about 20¢ to pay for the return postage. Wouldn't it be better to get German stamps at (anything up to twice) what they cost at the German Post Office, and use those to prepay that QSL? If the stateside station sends many cards overseas he may even be able to save enough money to buy a new linear if he gets stamps instead of IRC's. Of course with the linear he will work more stations and so send out more cards and save even more money. Or will he? Think about it.

Where do you the stateside ham get foreign stamps? You probably don't have to look further than your local radio club. Surely at least one of the members is a stamp collector. He will know where to obtain them. In case you can't locate a philatelist let me suggest one or two ways.

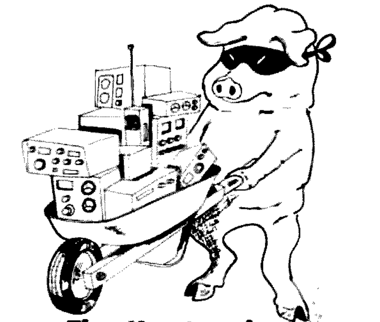
The cheapest way of obtaining unused (mint) foreign stamps is to get them at the local Post Office (overseas). Living in a different country that is obviously impossible, but the words "mail order" should be very familiar to the American ear. Practically every post office in the world runs a philatelic bureau to sell unused postage stamps to collectors all over the world. They will usually be only too pleased to put you on their mailing lists and send you periodic announcements of their new issues. With a small handling charge you can order any current stamp at face value. How do you find out what values of stamps you need? Simple, just ask in the QSO. Ask "what does it cost in your money to send an airmail letter to my country?" In case you forgot the foreign currency equivalent of 25¢ will usually be more than enough. Just drop a line to the Post Office Philatelic Bureau of his country (that should be enough address in most cases – after all the Post Office delivers the letters and they should know the address of one of their own departments) asking for details of their bureau and of their current issues. When you get the details, order any stamp or stamps that will make up the value you need. It will be better if you can arrange to order in bulk getting stamps for the other chaps at the radio club at the same time. This splits the small handling charge into a negligible sum. You can even con them into getting the stamps to put into their own albums, or to give to their nephews as a present or two, if they don't need them (or think they don't need them).

If you don't want to try the bureau route, and what direct QSLer does? to obtain postage stamps the alternative is to obtain them from a stamp dealer. Many stamp dealers put out weekly or monthly "new issue sheets" listing new world issues that they have for sale. Advertisements for these lists can be found in stamp collecting magazines available at your local magazine or book store or even in your local library. These dealers charge anything from 10% to 100% above face value for their services. This is more expensive than the bureau route, but what isn't. Just read the classified ads in the magazines, choose a dealer or two and ask to be put on the mailing list. If you order small amounts from time to time you should be able to stay on the list.

Another method of obtaining stamps is to have friends and/or relatives in overseas places and to get the stamps from them. If you can come to an arrangement with a member of the flight crew of an international airline, so much the better because you can save on the outward postage as well if he or she will mail your letter in the foreign country.

If anyone reading this is a philatelist, I have a small collection too. Perhaps you may be interested in trading one or two. If you have any information that a travelling ham might find useful let me know please, and I'll pass it on in this column.

G3ZCZ/W3



The Hamburglar
STRIKES AGAIN!

Stolen 10/8-Sonar FR-2528 scanner No. 21-4250. Standard src-851-SH 2 meter xcvr No. 9725. Standard src-707C 450MHz xcvr No. 2833. TPL PA-6-1DE 450Mhz amplifier No. 1092. RP MEA-22 synthesizer No. 212, and two LARSEN mobile antennas. Contact Mr. Ed Doherty, 25 Crescent Dr., Beacon NY 12508.

Standard Model SRC-146A FM transceiver in leather case, serial 208070, was stolen from aircraft at Los Angeles International Airport on October 5, 1973. Xtals installed – four amateur and one national weather service. Contact: Lt. W.L. Robinson, SLPD, Chief Security, Salt Lake City International. Phone (801)328-7652 or PO AMF Box 22084, Salt Lake City UT 84122.

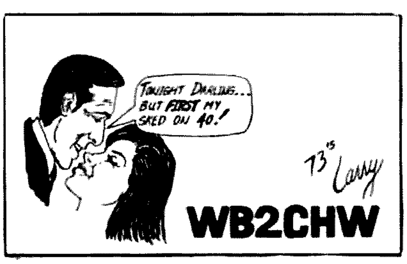
A Swan 270 M-252616 along with its automobile was stolen in front of the Holliday Inn in Sumpter SC on September 15, 1973. As of now it has

not been recovered. Contact Harold L. Manning W4NTB, 2107 Princess Place Drive, Wilmington NC 28401.

LIST FROM PAST ISSUES

AF68 No. 10888	K5LKL	1/73
PMR8 No. 10918		
M1070 pwr supply		
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA8WOA	4/73
NPC 107m pwr supply		
2, 5AJ-IPL Onan Gen., No. 327885		
R4B No. 11678G	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8390		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0653556		
HR-2 No. 04-C2879	W6GSR	6/73
SB-34 No. 211828		
STD 826 No. 011268	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G12279/CW	W4GF	7/73
HR-2 No. 0302030		
Clegg 27B No. 72013-1068	W3BXL	7/73
Std. 826MA No. 208078	WB2DEW	7/73
Drake ML-2 No. 10582	W3MSN	8/73
Tektronics 453 Scope	WB2FZU	8/73

QSL CONTEST

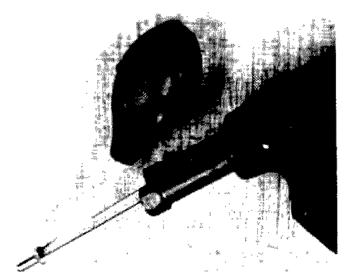


Larry Greenberg of Roslyn Ests. NY wins the QSL contest this month! Show your card to the world and win a free subscription to 73. Send your entry to QSL Contest, 73 Magazine, Peterborough NH 03458.

NEW PRODUCTS

SOLDER GUN TIPS

Many technicians, experimenters and electronic assembly workers have given up the use of soldering guns when working on solid state circuits because of the danger of causing damage to delicate components. Most now use low-wattage soldering irons and solder suckers. The development of a new solder gun element by Gunmaster Universal Industries which accommodates interchangeable solder ing tips and solder removers has re-



stored the solder gun as a practical tool for working on printed circuit boards.

The element, which will fit most of the popular solder guns, is permanently installed. For soldering, plastic sealing, marking, burning, etc., a tip, known as the SLUG, is screwed into the front end of the element. For removing solder by capillary action, the hollow bore desoldering tip, known as the DUM-DUM, is screwed in place. And for removing heavy solder deposits, a solder sucker may be attached to the back end of the DUM-DUM.

For more information on the versatile attachments, contact *Gunmaster Universal Industries, PO Box 743, Kings Park NY 11754.*

DIGITAL VOLTMETER

Now a low priced laboratory quality digital voltmeter is available from MITS, Inc. Model DVM 1600 measures alternating and direct current in five ranges from .1 ma to 1 amp. AC and DC voltage is measured in four ranges from one volt to 1000 volts. Measurement of ohms is in six ranges from 100 ohms to 10 megohms.

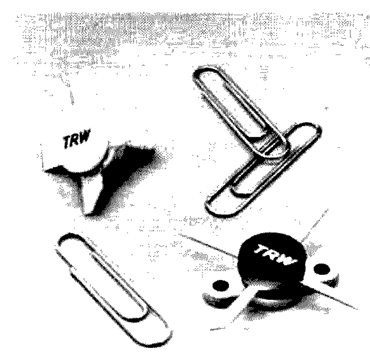
The resolution in low ranges for voltage is 10 mv; for current, 10 ma; and for resistance, 1 ohm. DC voltage accuracy is ± .5%. All other measurements are accurate to ± 1%. Input impedance for DC voltage measurement is 10 megohms; for AC voltage, 1 megohm.

The DVM 1600 also features auto polarity which automatically displays polarity and magnitude without probe reversal. Other features include a regulated power supply and 100% overrange capability on all ranges. Power requirements are 115/230 VAC, 50/60 Hz, 20 watts. The two plus digits are of bright, easy to read Sperry gas discharge. The attractive brushed aluminum case has an overhang for better visibility.

The MITS DVM 1600 is available in an easy to assembly kit or factory assembled. Warranty on the assembled model is one year on parts and labor. Kit warranty is ninety days on parts. The price is $89.95 for the kit and $129.95 assembled.

Contact *MITS Inc., 6328 Linn Avenue, NE, Albuquerque NM 87108, (505)265-7553.*

100 WATT PEP TRANSISTOR



A new 100 watt PEP and CW RF power transistor is now available from TRW Semiconductors, an Electronic Components Division of TRW Inc., Lawndale, California. The devices, designated PT5788 for the stud mounted version, and PT6665A for flange mounted, operate at 100 watts both peak envelope power and CW, which is believed to be a first in the high power range.

The devices are intended primarily for single sideband HF radio applications and should find many used in amateur radio.

The PT5788 and PT6665A feature intermodulation distortion of only 32dB and a minimum power gain of 14dB.

The rugged units incorporate thermally isolated cells and individually ballasted emitter sites for improved reliability and stable operation.

Up to 200 watts of power are available in an amplifier by combining two of the devices. Up to 320 watts and a power gain of 17dB can be achieved with 4 devices. TRW considers the 4-device unit a basic building block. Summing circuitry and mechanical links are widely available to make it easy to combine four of

LETTERS

A REPEATER STORY

Licensing our simple, manual, locally controled repeater turned into one of the most mixed-up and confused messes that could be imagined.

Drafted into applying for the repeater license was George Silvius W3LA, a retired army sgt. . .Dave Butler WA3SKJ, a communications engineer. . . and Al Brown WA3FYZ, a broadcast engineer. These diversified talents combined with the unclear and often contradictory instruction of the FCC, led to almost complete confusion these last few months.

Our story starts with the application. Since there are no repeater applications as such yet, modification had to be made to an FCC form 610-B, which is the application for a secondary station.

Next we had to determine the antenna gain, vertical and horizontal radiation patterns. By utilizing that acquired data, the effective radiated power was to be found, since the transmitter output power, and coaxial losses were readily available. (HA)

Finding the transmitter antenna height above average terrain was fun also. No less than forty points had to be plotted on a map and the average of these determined the average height of the terrain above sea level. This figure compared with the antenna height above sea level, gave our antenna height above average terrain (HAAA!) In our particular case it was minus six and one-fourth feet.

So now, all the data had been procured and was ready for filing with the FCC. The form 610-B had been modified, signed, dated, and all sections filled out. George even made a special trip to the library to make a xerox copy of his license to submit. A copy of the club constitution was readied. Five pages of algebra, arithmetic, logarithmic, and decibel conversions and graphs on antenna gain as 3.75 dB and even by our trial and error, hit and miss, flim-flam methods, we barely made 3 dB at times. EH!

By using a figure of around 3 dB, the ERP worked out to about 90w and George hand carried this entire package to the FCC in Gettysburg. They looked through it. . .said it seemed OK and since he was known so well up there that there was really no need for him to attach a copy of his license. So he didn't.

Well, after several weeks of hopeful anticipation, the repeater application was kicked back. It seems that although George was known in Gettysburg, he wasn't very popular in Washington. Back to the library. Application was refiled plus a photocopy of George's license minus the club constitution which the FCC said was superfluous information.

Well, once again, after several weeks of hopeful anticipation, a phone call from the FCC revealed that tests were run on that type of antenna and the true gain was found to be 2.8 dB. This meant recalculation of ERP. The next morning the FCC called again and the gain was down to 2.5 dB and the antenna was accepted on the FCC approved list. This meant recalculation again of the ERP and the deletion of five pages of information on antenna gain figures and patterns. By late afternoon the FCC dropped that figure to 2.0 dB. Seems strange that we had the only application with that type of antenna that did not say 3.75 dB. Oh well, we caluclated for 2.0 dB and resubmitted. The application was kicked back because there was no copy included of the W3CWC license. . .back to the library.

Three weeks after that we received the license and call sign WR3ABT, club repeater station. Licensed to Antietam Radio Association, George E. Silvius, Trustee.

Al Brown WA3FYZ
Dave Butler WA3SKJ
George Silvius W3LA

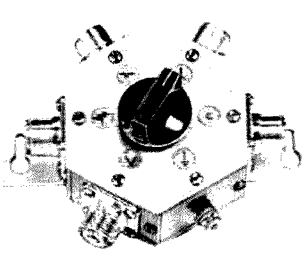
---

these building blocks to provide a 1kW amplifier.

Price for the PT5788 and PT6665A in 100 level quantities is $38.50. The units are available from authorized TRW distributors.

For further information contact *Sales Manager, TRW Semiconductors, an Electronic Components Division of TRW Inc., 14520 Avaiation Blvd., Lawndale CA 90260; phone (213)679-4561.*

ANTENNA SWITCH



The Heath HD-1234 is designed to switch one RF source to any one of several antennas or RF loads while grounding the unused outputs. Two Heathkit Coaxial Switches can be used to switch up to four antennas/loads to four different units (transceivers, transmitters, receivers, etc.).

Standing wave ratio to 250 MHz is 1.1:1 maximum. Power capability is 1000 W (2000 W PEP). A bracket is provided for mounting on equipment cabinets, desk or wall.

Price of the HD-1234 Coaxial Switch is $9.95 mail order. For more information, contact *Heath Company, Benton Harbor MI 49022; phone (616)983-3961.*

WHERE OH WHERE QSL?

The Radio Society of Okinawa has a substantial amount of QSL cards of both KA6 & KR6 calls. The hams who operated these stations have since left the island. Any former KR6 or KA6 holder who wants his cards contact the Radio Society of Okinawa, Box 465, Fort Buckner, APO San Francisco CA 96331. There are many call signs too numerous to list.

QSL Information: All KA6 QSL Cards should be sent to the Radio Society of Okinawa and not FEARL. The RSO operates and maintains its own QSL Bureau *

Due to the fact that the majority of our members and former members are in the Armed Forces it is impossible for us to reach them due to rotation and address changes. Your magazine could help enormously by publishing this notice.

Anne M. Szczesniak
QSL & Awards Manager
Radio Society of Okinawas,
Box 465 Fort Buckner
APO San Francisco CA 96331

VHF ENGINEERING

I'm not one for writing letters, except usually to complain about something great and evil to me, but the quality, courtsy, and service of one of your advertisers has overwhelmed me. I purchased a two meter FM transmitter kit fro, VHF Engineering shortly after they began advertising. After I disregarded their excellent directions and incorrectly constructed the unit, I mailed it to them. Five, yes only five days latter I received my unit back, repaired, no chargel (Try that with Heath.) The unit gets fantastic reports on the air. Then I purchased the 15 watt amp, and it was on the air in less than an hour after the postman arrived with equally excellent results. From time to time, as

they continue to upgrade their products, they, unsolicited by me, mail information on these upgrading procedures to me. . .at their prices, with their service, and with their high quality, what more could one ask. We need more VHF Engineering Corps in all areas. I wonder if they have considered the manufacture of automobiles. . .

Bob Fox K2MDM
Brooklyn NY

FCC COMMENTS

Just sent in comments on an FCC docket for the first time in my life, and I am going to blame you and the rest of the 73 staff for the cash I was forced to put out (not to mention the lost operating time). Had it not been for your prodding to make the amateur voice known, I would have sat nonchalantly at the operating desk enjoying myself, oblivious to whatever attrocities the FCC may be committing. While I now feel much better about having put in my two-cents worth, it has shown me why more amateurs do not bother to make comments, even on very important matters such as Docket 19759 (CB on 220 Mc.).

It is a difficult task to make yourself sit down and put your thoughts into words in a coherent manner. (Especially for me. . .I am a newspaper reporter and have to do this sort of thing all day, every day, so making myself do it on my own time is no simple matter. But you probably know how that is.) Even so, there is the matter of putting those thoughts into legal terms, and paying to have it reproduced since the FCC requires an original and 14 copies. Of course, if you happen to have a Xerox machine in your hamshack, this cost can be reduced considerably.

Somehow, though, it was an extremely enlightening and rewarding experience. I would not hesitate to do it again.

Charles Wright WA6SLS
Fresno CA

MORE PROSE

I have but one question to ask Mr. A. Prose Walker! Which CB company does he own?

ET'CR Mayward
Kwajalein MI

LORAN

I thought I would take a few minutes to write a quick note to correct a possible mis-conception you, and many of your readers, may have concerning the future of the LORAN "A" systems. You have stated several times that the 160m band would soon be rid of the interference of the LORAN as it is being phased out. May I take this opportunity to tell you of a few recent developments?

This LORAN chain (Central Pacific) was to be closed by the end of this year (as were several others). All LORAN "A" was to be phased out over the next three years. This was, I presume, considered sufficient time for the various organizations to purchase LORAN "C" receivers.

However, such a cry was raised in Washington by the fishermen, the airlines, and the military organizations that his chain has been told it will be operating at least until the end of 1974. Very few of the LORAN "A" stations are to be closed, and more than a few people feel that LORAN "A" will be operational until 1980.

Sorry to have to put a damper on those of us who enjoy operating on 160 meters, but LORAN "A" will be with us for some time.

Rod Mayward
APO San Francisco CA

CARF SI-ARRL NO

As a member of the largest radio club in Canada, the Ottawa Amateur Radio Club, I can report that the majority of members don't think very highly of the ARRL or their Canadian rep Noel Eaton. I think you'll see CARF (Canadian Amateur Radio Federation) gradually becoming the official voice of Canadian amateurs.

Keep up the good work with 73 and our sincere sympathies on your repeater regs.

Bill Stow

1950 PLL

So infallible is the synchronizing performance of Home Television Receivers of today that we are prone to forget the frustrations of picture rolling and tearing of the early sets. But here is a description of an actual occurrence where an ingenious approach alleviated synch problems, resulting in a Human Phase Lock System.

The occassion was the Milan Fair held in Italy in the early 1950's when American Companies were invited to display their receivers. There being no television stations in that Country at that time, participation meant the installation of a complete station with transmitter, cameras, pulse generating equipment as well as the receivers.

As was typical at that time, Vertical Hold of the picture was in step with the power line frequency, a very stable source in the USA. Over there at that time it was not so stable, being allowed to vary as much as several Hertz * American pulse generators would frequently cop out on these wide excursions and receivers would begin their picture rolling.

Our engineer, now WB4ITQ was interested in preserving the technical excellance of our gear and took a Table Model receiver by car to the nearby power station. Here in glorious sales technique, he gave the operating engineer a vivid description of the wonders of Television, and offering to set one up in the power station for him to watch. Of course an immediate comraderie was established and within minutes a picture was received.

"Ah but that rolling – can it not be stopped? " was the comment of the operator.

"But of course," said our Ham friend. "You just turn this big wheel on your generator like this and Presto!, the picture stops rolling."

As our friend left the power station the operator was smiling, leaning back in his big chair with his feet on the desk, and carefully adjusting the BIG WHEEL so he could enjoy the show.

Progress is important, and so satisfying.

W2IK

ALARMED COMMENT

Re hams selling alarms: I've been selling alarms for about half a year now. I haven't made a killing but have been doing pretty well. I have a demonstration model I use and if anyone has a need for plans for it just send a S.A.S.E. and I'll see what I can do.

Ken Dinsmore
KENCRAFT ARLARMS
10601 Washington Way
Everett WA 98204

FM AGAIN!

You probably don't remember but last spring my friend and I visited your offices and you asked me if I was on 2m FM. The answer was no, but for the past four months about 99% of my activity has been on 2m FM. Thanks for being such an effective catalyst. I've never had so much fun with the hobby!

Jim Kocsis WA9PYH
South Bend IN

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Act of August 23, 1970: Section 3685. Title 39, United States Code) 1. Title of Publication 73 Magazine. 2. Date of Filing 20 September, 1973. 3. Frequency of issue, Monthly. 4. Location of known office of Publication (Street, city, county, stale ZIP Code) (Not printers) Pine, Peterborough, Hillsboro, NH 03458. 5. Location of the Headquarters or General Business Offices of the Publishers (Not printers) Pine, Peterborough, Hillsboro, NH 03458. 6. Names and address of publisher,*editor, and managing editor. Publisher (Name and address) Wayne Green, Peterborough NH 03458. Editor (Name and address) Wayne Green, Peterborough NH 03458. Manager Editor (Name and address) Ronald Subka, 73, Peterborough NH 03458. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent of more of tatal amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a parternership or other unincorporated firm, its name and address, as well as that of each individual must be given.) Name 73 Inc Peterborough NH 03458. Wayne Green, sole stockholder Peterborough NH 03458. 8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state) Name none (Signature and title of editor, publisher, business manager, or owner) Wayne Green. 11. Extent and nature of circulation. Average no. copies each issue during preceding 12 months. Actual number of copies of single issue published near EST to filing date. A. Total No. of copies printed (Net Press Run) X,79431, Y,79600. B. Paid circulation. 1. Sales through dealers and carriers, street vendors and counter sales. 2. Mail subscriptions X,77983, Y78115. C. Total paid circulation X,77983, Y,78115. D. Free distribution by mail, carrier or other means. 1. Samples, complimentary, and other free copies X,225, Y,237. 2. Copies distributed to news agents, but not sold. E. Total distribution (Sum of C and D) X,78208, Y,78352. F. Office use, left—over, unaccounted, spoiled after printing. X,1223, Y,1248. G. Total (Sum of E & F – should equal net press run shown in A) X,79431, Y,79600. (Signature of editor, publisher, business manager, or owner). I certify that the statements made by me above are correct and complete. Signed, Wayne Green.

W2NSD/1 continued from page 4.

AVOIDING IRS DIFFICULTIES

In case there are some readers who have their own businesses, who someday may have their own businesses, or who know someone who has or may have his (or her) own business, I think I may have some advice worthy of note.

Number one. . .when you pick an accountant, be sure that he is experienced with taxes and with dealing with the IRS. Be *sure!* Remember that chances are that the only reason you have to pay for an accountant is to prepare your tax returns. Any reasonably good bookkeeper can do all of the accounting you'll need to run your business and have a fair idea of its shape.

The tax laws are so complex that it is impossible to even get two IRS agents to agree about them and the interpretations of them. We get just a taste of this with our wretched repeater regulations, where the best brains of hamdom are bewildered. Well, imagine that situation multiplied by several thousand times. The IRS continually holds schools to try and keep their agents up on the newest aspects of the rules, but there's no way. Now, if the people who are running the show can't agree on their own rules, how can the ordinary taxpaying businessman ever hope to cope with this morass? The answer is that he is a sitting duck, waiting to be knocked off by any IRS agent that happens to aim in his direction.

A good accountant with IRS tax experience can protect you from these cossacks. Remember that bunch of Russian gangsters who used to ride into a village and pillage it? If you have an accountant who understands how the IRS functions you will never ever have to face the agents and you will not have to face a judge either, unless you happen to be a political martyr, a mafia godfather, or a crook. . .or any two of that set.

The average businessman depends on his accountant to make sure that his bookkeeper does not get him and the business in trouble with the IRS. Since no one, not even the best IRS agent, can be positive about every expense made by the company or corporation and know for sure that some agent won't come along and declare it a personal expense, it is up to the accountant to guide the bookkeeper in this situation and to try and make sure that the client does not get in trouble. This is so involved that there is no possible way for a businessman to double check the accounts on this, he just has to depend on his accountant and bookkeeper.

Should an IRS audit ever materialize, the businessman depends on the accountant to take over and handle it. There should *never* be a time when he should have to talk with the agent.

It is odd, I think that even though the expense of an accounting firm is brought on almost entirely by the demands of the IRS, that a business can't take this expense off as a deduction. This is obviously inequitable. A routine IRS audit costs around $3000 in accounting fees. . .certainly *that* should be deductible! How come expenses which are forced by the government and not by the needs of the business itself can't be recovered?

They have some of the same problems with sales taxes, as I recall. Businesses have to collect these taxes for the state or city and bear the expense of collecting them and keeping the records involved. Hey, Ralph Nader, where *are* you?

If my memory serves, the whole business of income taxes is out in left field and has never been ordained by the Supreme Court. It got started around 1912 or so, with a miniscule tax and the promise that it was a short term thing which would be removed when the immediate need was over. The Court has avoided coming to grips with this tax, probably on the grounds that to overturn it at this date would be to overturn the country. The IRS has gotten too big even for the Supreme Court! There is little doubt that the Court would have to declare income taxes unconstitutional if they ever let the question arise, so they have to make sure that it doesn't come up. . .which they do by ignoring it.

TAXPAYER COMPLIANCE PROGRAM

The IRS is always looking to strike fear into the hearts of the taxpayers in order to scare them out of trying to avoid taxes. In addition to their well-oiled public relations staff, which turns out pro-IRS propaganda by the ton, they have a very scary policy which is called the "Taxpayer Compliance Program." They are secretive about this program, undoubtedly because if the public knew that they were throwing away money on such a thing the chances are there might be a taxpayer complaint of sizable proportions.

Despite federal laws which are most clear in the right of citizens to see such government manuals, the IRS rulebook regarding this program has been kept hidden away and even its existance has been denied by the IRS. One man has spent years trying to force the IRS to live up to the federal laws which should force them to let him see their published instruction manuals for agents.

The Taxpayer Compliance Program is an expensive one, but apparently is justifiable in the minds of the IRS heads. What they do is take a case where a small businessman is being given the shaft by a special agent and call in hundreds upon hundreds of witnesses to testify against him. They call in people from all over the country for even the smallest amounts. It might seem odd to the rational person for the IRS to fly someone from one coast to the other, pay their expenses for the trip and the hotel, all for a $5 expense. The bill could come to nearly S1000, and certainly would be no less than $500.

Why such extravagance? Well, firstly there is no one to control the IRS from such wasteful spending. Then there is the rationale that in the long run it is worth the money because the person who is brought in to testify will go home and tell all his friends, family and co-workers that they better damned well pay their taxes. This is supposed to justify almost anything in the way of expense.

Put yourself in the position of such a "witness." Let's say you are the circulation manager of a magazine in California. The IRS special agent comes to you one day and asks you to verify that a publisher did, in 1966, buy a subscription to your magazine, a one year subscription for $5. You check your records and say yes, this is true. Then the special agent returns in a few days with a sworn statement of this for you to sign. The next thing you hear is that you are to be ready to appear as a witness for the IRS in the prosecution and not to leave the country. Never mind that you have a trip to Tahiti that you've been getting ready for or a business trip to Japan, you're stuck. You can imagine what you'd think of the IRS *and* the publisher.

Hundreds upon hundreds of such "witnesses" are harrassed by the IRS in "cases" such as this. Some are threatened and intimidated, and many have been inconvenienced to a substantial extent. Just about all are scared and annoyed. The Taxpayer Compliance Program swings along.
would bring a witness all the way across the country to testify to one magazine subscription for $5. The IRS special agent has decided that subscriptions to other magazines is not a business expense and thus has chalked it up as a personal expense of the head of the company. Has the special agent asked what the purpose of the magazine subscription was? No.

And how much tax is involved in a $5 disallowal? Well, that means that the taxpayer has $5 more in income — income not declared to the IRS — and if he is in the $12,000 range this would mean a tax of about $2.50.

Add to that the 50% penalty for not paying the tax, and you have $3.75. Then add 6% interest per year and you are up to $5.98 in tax due. Okay, the taxpayer is billed $5.98 for a $5 disallowed expense. . .but this still leaves the company owing too. Taking $5 off the expenses of the company means that the company earned $5 more than it reported. If the company is making a modest profit this undeclared income would be taxed at 50%, $2.50. . .plus the 50% penalty for it being unreported, plus 66% gives you another $5.98 due. Thus IRS is able to run up a tax bill of $11.96 when they disallow one $5 item.

That $11.96 doesn't even come close to the $1000 it costs to bring in the witness, but that is how the Taxpayer Compliance Program works.

TAX ACCOUNTANTS ARE HARD TO FIND

While 73 Magazine was based in New York we had no problem in having a fine tax accountant. . .one of the best. Then we moved to New Hampshire and looked around for someone with tax experience in the area, and could find no one.

One of the blacker days of 73's history was when our next door neighbor lost his job as head of the Guernsey association here in Peterborough and became the local representative of General Business Systems, a large national accounting firm. We got talked into using this service. Then, when the IRS agent arrived for an audit, the local rep deserted us and left us to handle the situation alone. This is absolutely unforgivable for an accountant. No client should *ever* have to deal with an IRS agent.

Word of wisdom: should this ever happen to you, run, do not walk, to a good tax accountant. Don't fool around. Don't for one minute think that just because you have been honest in every way that you can't have prison and shattering expenses ahead of you.

If you know of any business that is thinking in terms of using General Business Service, you might ask them to drop me a line and I'll tell them simply and factually how I go the run around.

We'll have more on the IRS next month. Move over, Nadar.

REPEATER APPLICATIONS

The news from the FCC is bleak indeed. It appears that all pretense of providing any sort of efficient service has gone out the window and groups figuring to put new repeaters on the air or to modify present repeaters are faced with incredible delays.

Some groups have met his bureaucratic bungle (Walker, we all told you this would happen if you insisted on the mountains of paperwork – and you denied that it could happen) by running repeaters on an informal basis without identification. Obviously no magazine can suggest that this is a good approach to the problem – but the fact is that there is no good approach to the problem.

There are reports of several groups that are just throwing the new rules to the winds – with one in the East now boasting almost 50 members, none using their calls over the repeater – shades of CB! We are seeing how one man has been able to get the destruction of an extremely valuable service started – cheers, Walker.

Many groups are groping with the new rules – rules which have frustrated the top minds in repeaters – trying to wend their way through the legal thickets toward that legal ticket. The ARRL has a form that may help – send a sase for the Repeater Station Application form. It's five pages long, so put on a couple stamps. That's ARRL, Newington CT 06111, in case you've lost their address or are not familiar with the outfit.

NO SAROC THIS YEAR

The Saroc convention was such a bomb last winter that we here at 73 vowed that we would pass it up this time. The whole thing consisted entirely of a few commercial exhibits as far as the "convention" was concerned, with virtually nothing planned for talks or forums. It was so blatently commercial that it made us sick. It was obvious that the whole thing was just a ruse to such hams into coming to Las Vegas to drop their money at the gambling tables.

Who needs it?

If the time comes when the ham going to Saroc is given a fair shake, then perhaps we'll come out again. But the show isn't even run by hams any more as far as we know. The last we heard the local hams wouldn't touch the "convention" with a ten foot pole.

For the price of a lost weekend in Los Vegas you can get quite a bit of ham gear and have fun for years instead of a few minutes. . .if that.

For two years running Saroc has been a bust. Few of the hams that came two years ago showed up last year – so who will be there this time? They're running out of suckers.

FCC EMPLOYEE DIES

Though the FCC denies the story, word has reached 73 Magazine that tragedy had struck the amateur division of the FCC in their Washington office. The death of the unnamed employee might have gone undiscovered except for an alert visitor from a repeater group in Iowa who insisted on finding out what had happened to his application for a license, about which nothing had been heard for several months.

The visitor was shown to the repeater application processing room and he began searching through the mountains of filings. Imagine his horror when he lifted one particularly heavy manuscript and discovered a withered hand showing in the gap!

One official remarked that some of the secretaries had thought it odd, but not without precedent that nothing had been in the outbasket of that department for several weeks.

The death triggered an immediate investigation of other nearby offices and, for a few moments it was feared that a second employee might have passed away, but the paycheck test turned out to be positive and everyone was relieved to find that the chap was merely asleep.

Since the normal working posture for so many of the people in that department is difficult to tell from sleeping, a good deal of caution is used in attempting to discover if an employee is working, sleeping or deceased. The best test discovered so far is the waving of a paycheck hear the employee. In most cases, even in deepest sleep, it will be grasped. This is not always a totally reliable test, for the reaction to a paycheck is so strong in some employees that even in death the hand will reach out.

REPEATER LICENSES

The latest reports from the FCC are that things are bogged down beyond all description. They have sorted out the mess into three big piles – the old applic tions for repeaters needing relicensing – new applications for repeater licenses – and modifications to present licenses. I gather that we are looking at a one to two year delay, unless some sort of basic changes, not yet in the works, are made.

It serves no useful purpose to stand around pointing a finger at Walker saying we told you so.

Hopefully the hearing in January will grease the shute so the new rules can be thrown out and further time and money by the FCC saved.

If the profusion of unneeded and discouraging limitations on repeaters is not thrown out, it could take a couple years to license a new repeater. The FCC admits to over 600 applications being on file!

NEW ENGLAND CONVENTION

There was good and there was bad.

The weather turned out to be excellent, but since almost all of the action was inside, this was a plus that many convention goers missed.

It was a little difficult for some of the amateurs who were not among the wealthy elite to drive by motels with $8 off–season signs to go to the $28 a night Dunfey's. That was the special convention rate – it's even higher during the season!

The two dozen or so exhibitors had no serious complaints on the number of hams that turned up on the weekend. Some were grumbling quite a bit on Saturday, when it was surprisingly deserted – particularly those who had been to the Evans Radio Open House, which was really packed – and that was way up in Concord, New Hampshire the weekend before! The Sunday crowds were much better than expected, and made the trip worthwhile for most exhibitors.

The flea market was spotty, with only a handful of fleas present.

The hotel food was bad and incredibly expensive – which accounted for the large number of conventioneers walking around with Burger King food trays brought in from a couple blocks away. The chef at Dunfey's may be one of the world's great experts in removing the taste from virtually every type of food, while retaining its appearance. Perhaps soy bean food is here and can now be made to look like chicken, corn, and potatoes. Certainly chicken is here that can be made to taste like soy bean curds – or was it more like mongo beans?

Admittedly my nose was out of joint, and it would have been difficult for me to see things with any rosy glasses. This all started several months ago when I offered to set up the FM program for the convention – and my offer was accepted. Unfortunately the program chairman had not cleared this with Newington and Huntoon.

It didn't take long for the – er, fur, to fly and it ended with the program chairman having to call me and tell me that for the third New England convention in a row I would not be premitted to speak on any forum or at any banquet. The FM program was being taken over by Bruce Marcus and Gordon Pugh. This was somewhat of a disappointment, as you might imagine.

The fact is that I do not hold either of these amateurs in great esteem – and my reasons would fill a book. With some encouragement they *will* fill a book.

Since I had quite a bit of news to bring to the convention I was disappointed not to be able to speak. I wanted to tell them about the hearing Chairman Burch has arranged for us in January – about the further developments in Jordan – about possibilities for development of amateur radio in several other countries that has evolved from this pioneering thrust – and about late news in the fight to save the 220 MHz band.

So, instead of giving talks, I stood in my booth and sold subscriptions and listened to gripes from exhibitors. For some reason many o them were grumbling that little was selling – it was a different type of crowd from that bunch of buying fools that go to Dayton and pick every booth clean. Somehow the convention did not seem to bring out many of the active hams who are doing most of the buying these days.

Several new items were on display and drew a good deal of attention. Venus was showing their new slow scan equipment – which seems to work very well. Emergency Beacon was there with their new FM unit – the one which has everything built in that you can imagine. The $1000 ticket on it slowed some of us down, but we must remember that the difference between a man and a boy is the price of his toy. This will separate the me from the boys.

One of the convention attendees was Julian Sobin and his wife (of Sobin Chemical) and they are headed over to China again for another visit. I have hopes that they will be able to help open up an interest in amateur radio in China. I sent along a package of back issues of 73 to churn the water. Wouldn't it be wonderful if I could get over there and convince them to go the same route as Jordan! There is nothing that China could do that would be more helpful to them in opening up their country for development – communications is one of the most basic needs for the growth of any country – and this means people who understand communications – and how better to get them than through amateur radio?

On the strength of this opening I sat down and wrote a one page introduction to the importance of amateur radio, explaining the concept of growth through the development of communications – and the role that amateur radio plays in this – ending with the example of Jordan. Copies of this paper are available to anyone who has a good use for it. I suggest sending it with a covering letter to the officials of any emerging nation that you may personally know. Let's get this thing started! I stand ready to pack my toothbrush and go anywhere in the world where they are interested in getting amateur radio going – I'll show them how to go about it – write regulations fitted to their needs – and, if it will help, even set up a station or two – and perhaps a repeater.

Since the ARRL HQ went to so much trouble to screw me, many of the exhibitors seemed to feel that I should be the center of their complaints about the convention – so I got an earfull of the miseries they were having – such as an almost utter lack of cooperation on the part of the hotel in supplying electricity for some exhibits – ceiling lights that were out and darkened some of the exhibits – electricians apparently explained that they had been out for a couple years and nothing could be done – the high charges for stored boxes – Collins had a bill for $15 just for storage! – and the odd layout which put some of the exhibits way back in a corner where few convention goers ever found them. I wase't surprised at all to find the 73 booth back there – I think we got perhaps a hundred amateurs who managed to find the out of the way corner on Saturday – on Sunday morning we moved the damned tables out of that booth and up front by the entrance where we could at least be seen.

In talks with Frank Warnock of the Dayton group, I suggested that next year the Dayton committee have a group of amateurs watch the parking lots of the major motels to try and prevent the thefts of mobile rigs and antennas which marred the Dayton Hamvention this year. The New England convention could sue some of the same. I was more than a little upset to come out of the hotel on Saturday and find that my two meter antenna had been stolen from the car. Several other amateurs had similar complaints, and some apparently lost complete mobile setups. A watch from about 11 pm until 7 am would be easy to arrange, and would be a valuable service to everyone but the manufacturers and distributors of antennas.

Keith spent a good deal of the convention flying around in his plane with the Clegg 220 repeater in it, helping new 220 repeater records to be set. The amateurs down in Lancaster (PA) were able to work through the repeater all the way up to Providence (RI)! It is obvious that a plane is the proper place for a repeater.

About the only real sour notes were comments from the two darlings of the League HQ, Marcus and Dana, who put most CBers to shame with their vile language. It is disgusting to hear a League official talk over the air using language like that. Many of us look to League officials to set a good example on the air and are deeply disturbed to hear otherwise. With the exception of the temporary 19/79 repeater, two meters was well repre-

sented. The main repeater set up was the Derry NH group WR1ABQ on 25/85, with an assist from the WR1ABV 04/64 group from Waltham. The 07/67 WA1MHN group put on a whale of a party. And so it went.

The Clegg exhibit was a point of major interest, with the new 220 repeater being shown and the club purchase plan being explained. This is a clever system whereby a club can buy the repeater on time, and the payments grow smaller as more and more of the club members buy Clegg 21 transceivers to use with the system.

Several clubs have gotten started with this ingenious system already and are pioneering on 220 MHz. Operation up there is a dream – no interference – and the range seems to be even better than two meters in most cases. In areas where there are too many two meter repeaters, this would seem like a good way to go. There is also the element of sharing in the development of this relatively unused band – the pride of knowing that you are in there doing something – and having fun to boot.

NIKON SCHOOL

Nikon has organized a few teams of experts who go around the country giving two day short courses in photography, with the emphasis on Nikon cameras. I finally managed to get together with one of these in October and found it most valuable. Unfortunately, now I have a serious need for a lot of equipment that I never knew I needed before. I wonder if any readers have some Nikon accessories they might want to swap for a subscription to 73 or modest amounts of money? I'm needing such things as the No.4 bellows, the No.4 slide copier, any of the filters, extension ring K set, BR2 ring, BR3 ring – things like that.

In the past I have visited many clubs, bringing along my slides of one or two countries and showing them. With a slide copier I can see where I could make some good copies and thus have slide programs to lend out with a cassette tape commentary for club meetings that I can't get to. My programs on 5Z4 – ET – SU – JY – OD – YK – YI – YA – VU – XZ – HS – 9V – FK – VR2 – 5W1 – KS6 – KC4 – VP9 – VP7 – 5B4 and a few other might be interesting.

A recent poll indicated that about one third of the 73 readers are into photography as a second hobby – so the Nikon school may be of interest when it comes your way. Zeus knows we need better pictures to go with articles and it is a rare month indeed when we have anything usable on hand for a cover, despite our requests for good cover pictures.

OCEANUS CALLS

One of the newest "countries" of the world is Oceanus – and it is also by far the largest country of the world. Oceanus comprises all of the oceans of the world outside of the three mile limits of land.

For some odd reason the oceans of the world have never been claimed as territory, even though they are all underlaid with ground as solid as that above the water. In early days the limits of land territory went to the water's edge. Then this was extended to a three mile limit. Recently some countries have decided that their territories go out to a 12 mile limit – and even a 200 mile limit has been claimed by some countries who are into protecting the fishing rights.

But as the development of the oceans progresses, with oil wells being drilled many miles out at sea, and other minerals becoming practical to mine at sea, the concept of the sea as territory will evolve.

Oceanus has set up a government of the oceans of the world – with a constitution similar to that of the United States, and is hoping to achieve recognition of the ownership of the oceans in the name of all mankind. A bill is now in the Senate to have the U.S. recognize Oceanus and feelers are out to several other nations of the world. The advantages to the land-locked countries is obvious – they would have a share in the oceans which otherwise would be denied them – and since the oceans may one day be a major part of the wealth of the world, it would be almost foolish to turn down an opportunity to invest in this concept.

One immediate goal of the Oceanus government is to keep the oceans clean for the future – to bring spoilers of the ocean to court – to insist that oil spills be cleaned up – that new wells be drilled only when there is a surity that no oil will be spilled that will not be cleaned up – that endangered species of ocean life will be protected.

Oceanus has set up a system of registering ships and there are some advantages to registering vessels under the Oceanus registry. This does not prevent dual registration under any other country's flag, of course.

Amateurs operating aboard Oceanus registered vessles may be interested in applying for an Oceanus call. Calls starting with the single letter "O" will be issued to amateurs holding valid amateur licenses issued by other governments. The ITU has been notified of this.

Citizenship in Oceanus is open to the citizens of any other country and does not in any way affect prior citizenship. Dual citizenship is common these days. Citizens of Oceanus will be issued an Oceanus passport.

Getting an Oceanus License

In order to get an Oceanus amateur radio license you must be a citizen of Oceanus – which is included in the license fee. Send a statement as follows, "I wish to be enroled as an Oceanus citizen, not to supercede my previous citizenship committments." Please state your present citizenship, furnish a copy of your presently valid amateur license, and include $5 in U.S. funds or the foreign equivalent.

Send this to Oceanus, Office of Telecommunications, 73 Magazine Street, Peterborough NH 03458. Please make the check out to Oceanus.

Calls will be issued starting with O1AA and progressing to OØZZ.

GOING FIRST CLASS

The Emergency Beacon ad for their new superfantastic two meter rig got me to thinking about my philosophy of cheapskating my way through life. By making do with the least expensive way of getting on different bands I suspect that I've missed a lot of fun that I might have had.

Building is fun, and converting surplus is fun too, but perhaps I would have gotten a bit more out of amateur radio if I had prusued those aspects of the hobby for themselves rather than as a way to save money. On the other hand, perhaps, if I'd gone the first class route, I might not have had the drive to build and convert, and I might have missed a lot.

Back in 1965 I got fed up with making do with this and that and decided to go first class for once. Well, perhaps not truly first class, but certainly a high second class. I put up a full sized three element twenty meter beam – a brand new transceiver – and a Henry 2K – 70 foot tower – and I got busy on 20m and had a ball. Compared to other hobbies the investment was very modest, perhaps S1200 for the works. That won't take you far in sports cars or planes – or boats.

The signal was first class, and able to get through most pileups(except over Asia way where big trees shield the signal). The result of my big investment in 1965 was that I've had nine beautiful years of being able to work DX. I'm not a big country hunter, but I've worked 100 in one weekend, just to prove that it can be done – and I'm somewhere over 300 total. Not being a certificate fiend, I haven't counted them up for a couple of years.

Going first class has not seemed to substantially dent my enthusiam for building and playing around with new gadgets. I've had a lot of fun with

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

DISCOUNT PRICES plus full warranty, call or write for fast quote on new radios and accessories. SBE144 199.95; Midland 13500 219.95; 13520 W-T 209.95; 20% plus discount off list price Hygain, Mosley; TH6DXX 143.00; Classic 33 124.00; 15% plus discount off list Triex, Rohn, Standard, Collins, Clegg FM 27B 479.00 list; Drake, Swan, Tentec: Write tradein prices. Ham-M 99.00; TR44 59.95; Belden 8448 rotor cable .10/ft; 8214 RG8 foam .17/ft; Motorola HEP170 epoxy diode 2.5A/1000PIV .29, 25.00/1000 lot; Calrad KW SWR-relative power dual-meter bridge 15.95; Free flyer. Shipping charges collect. All items guaranteed. Madison Electronics, 1508 McKinney, Houston TX 77002. (713)224-2668. Nite/weekend (713)497-5683.

GOING TO SCHOOL, must sell following gear: Deluxe Clegg 6m SSB receiver, only $230, with power supply. Heathkit twoer, A-1 condition, only $30. Conar 25 watt CW transmitter, only $15. Heathkit DX-60 it, not assembled, parts missing, only $30. You pay shipping. Write: S. Couch WBØGAR, 1815 Princeton, Ottawa KS 66067.

GONSET G-50 6m Communicator, 6 element Cushcraft 6m beam. Best offer. Mort Cohen WA2ARS, 3 Elk Lane, Centereach NY (516)928-2673.

FREE BOOK about Digital Logic and Computers, and how you can design and build your own. EEW, Box 8204-BC, Pittsburgh PA 15217.

SB-34 SIDEBAND TRANSCEIVER 75-15m, built in AC/DC supplies plus never used mobile mount. Total operating time on rig near 20 hrs., almost brand new! Sorry, no microphone. $225. Ron Subka WA9FPP/1, Russell Station Rd., Francestown NH 03043.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis. Please send Money Orders or Certified Checks only to 73 Magazine, Peterborough NH 03458.

Cap-Com 40m solid state SSB xcvr	$150
Heath IB-101 counter with Vanguard Scaler	$250
Clegg 27B 2m xcvr	$380
IC-22 2m FM xcvr	$246
Midland 13500 2m xcvr	$200
Midland 13509 220 xcvr	$200
Tempo CL-220 220 xcvr	$200
Clegg FM-21 220 xcvr	$255
Regency HR-6 6m xcvr	$190
HR2MS 8 channel scanning 2m xcvr	$255
TME-H-LMU 16 channel rcvr	$255
Digital Logiclocks	$ 80
Dycom 2m repeater	$425
Wilson 7 element 10 & 15m beam (pick-up only)	$250
Waller 60A power supply	$105
Standard sr-c 120/5 power sup.	$ 44
Gladding 12V power supply	$ 60
SBE Scannavision	$650
Robot Monitor	$265
Robot Camera	$265
AX 190 amateur rcvr	$200
SX 190 SWL rcvr	$200
Pickering KB-1 keyboard	$200
TPL 502-B 2m Amp 1w/40w	$110
TPL 502 2m Amp 10w/45w	$ 90
Heath HW-202 w/encoder	$180
Heath HWA-202-1	$ 30
Heath HA-2022 amplifier	$ 70
Gladding 8 channel scanner	$110
Gladding HI-Scan	$150
Regency TMR-8-U Scanner	$140
Tempo fmh charger	
Heath HM-2102 wattmeter	$ 30
GTX-2 FM xcvr	$225
Newsom 2m KW amplifier	$350
Temp-ONE SSB xcvr	$275
External VFO	$ 80
AC-One power supply	$ 80
FPM 300 SSB xcvr	$480
Heath IC-2009 calculator	$ 90
SBE 450 FM xcvr	$340
MITS calculater w/ac adaptor and case	$130
Memory-Matic 8000	$320

GENERAL ELECTRIC VOICE COMMANDER III solid state 1 watt 2m portable. Excellent condition w/nicad batteries, charger, leather case, strap and remote mic. Complete GE data file included $90 ppd. 2 ea. GE MT-33 transistor powered prog. 30 watt 2m mint cond. with dusty accessories $90 ea. Complete GE Mastr pro. 70 watt 450 MHz. mobile minus basket, Morotola Motrac 50 watt 6m U51HHT with PL. Looking for Motorola Motrac and Motran 450 MHz. Write with your needs, will trade. John Thornton, 12585 Jones Bar Road, Nevada City CA 95959.

DRAKE R4B: Absolutely MINT! Proof of recent factory alignment – $335. Galaxy Mark II, A.C. Supply, Remote VFO, VOX, Clock-Phone Patch Console, Mike – S375. Bill Handel K8SSY/6, 750 Stierlin Rd. Apt. 131, Mountain View CA 94043. (415)-965-2691.

ENHANCE, FRAME & ORGANIZE your QSL cards with 20 pocket plastic holders. Two for $1, seven for $3, prepaid-guaranteed. TEPABCO, Box 198M, Gallatin TN 37066.

JEHOVAH'S WITNESSES WHO ARE AMATEURS Please write: Bob Ellis WA4UQQ, 160 Lagoon Road SE, Winter Haven FL 33880, or call 813-293-3595.

STANDARD SRC-826M 2M FM Transceiver with Newtronics mobile collinear. 52-52 & 16-76 added. $275. Lawrence Rachman WA2BUX, 2 Maggio Lane, Old Bethpage NY 11804 (516) 694-3487.

FREE with the purchase of a new Genave GTX-200 at $259.95: 18 crystals of your choice. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Standard, Clegg, Regency, Midland, Hallicrafters, Tempo, Kenwood, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Mosley, Sony, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, Inc., RR25, Box 403, Terre Haute IN 47802. (812)894-2397.

FOR SALE: Motorola, G.E., RCA FM mobiles. Hammarlund HX 500 and HQ 170A. 3 in. refracting telescope. Radio magazines back 25 years. SASE for details. W9DGV, 2210-30th Street, Rock Island IL 61201.

TOUCHTONE: Aeco receiver with schematics, $50; desktop pads with cases, $20; Trimline TT phones complete, $25; keyboards, oscillators $8 ea; Genl. Radio slotted line type 874-LBA, with stubs, adj. lines, etc., $150. Mod 19, synch, with CV-89A TU, $100. Repairs and engrg. info on Automatic Electric Co. eqpt. Swaps invited, want 2m base station, Mod 14 typing reperf. Doug WA1QEV, 3 Hall Ave., Nashua NH 03060.

SWAN CYGNET 270B 10-80M transceiver. Mint condition 1 1/2 years old. Call or write WA1QLK 15 Greenough St., Brookline MA 02146. (617)734-0661 Asking $390.

R-390A. Clean, good condition electrically, mechanically. $456. Includes crating and shipping. W6ME, 4178 Chasin Street, Oceanside CA 92054.

RTTY, with slow scan, and things like that. It has made it so I could sit and talk with friends around the world with a lot less interference problems.

On two meters I've gone about the same route. I started off with jury–rigged gear and eventually went the first class route – and have been thankful ever since I made the change. I run a 22–channel rig with a nice TPL 130 watt amplifier – and I work out extremely well. You can be sure that I'll be getting a synthesized rig as soon as they are available in quantity. . .and I can find one that fits my car. I wonder if I can fit one of those EBC rigs in there. . .?

Going first class costs a little more, but the extra fun involved seems to more than make up for the little more per day that it costs. I will always remember an old buddy of mine who used to have the motto, "For a few cents extra you can go first class."

DESPITE WALKER'S –

Promise to throw out any petitions for repeater rule changes, made to the group at Rochester, the McCoy wing of the ARRL is working on another attempt to get Walker to back down via the petition route. In view of the upcoming hearing before the Commissioners in January, this might be a way to take some of the hear off for Walker.

The ARRL petition is a compromise affair, asking for some needed changes, but falling far short of asking for what is really important: freedom from restrictive regulations which have no real purpose. For instance, they will ask that the repeater channels be considered for repeater use and the Walker concept of simplex use forcing a repeater to shut down be given a proper burial. They would like to have the antenna patterns deleted. They want repeaters to be able to make changes without prior approval by Walker – which could save a year or two at the present snail's pace of the FCC. They want no limit to the number of control operators – there was no limit set in the regulations, only in the Walker interpretations. They want crossband – and so does everyone else. Walker gets livid when this is brought up. Repeaters should be linked as desired. They would like an increase in 6m power allowance – I'd like to see all power limitations taken off other than our basic mandate of one kilowatt.

The ARRL is going to ask for control on the same channel – and, if there is any real question about economy of channels, this makes sense. It can be done quite effectively, so why require a 450 link? They also want any kind of control legalized – our responsibility should be to control the repeater in the best way for each of us – and it's none of the FCC's business how we do it, whether it be by direct control, wire line, link, etc.

Since the FCC demanded maps are not available for all parts of the country they are going to ask that substitute maps be accepted. Nuts, sez I, why should we have to submit any map at all? The FCC isn't setting up our repeaters like FM stations, so this is a complete waste of our time and money and to no possible purpose.

My own idea is that we should ask the Commission to throw out all of the restrictions set up in docket 18803. Most of these objectionable rules were set up to help us avoid future problems which Walker imagined we might encounter. Since he apparently was not well versed on our present state of the repeater art, it is not surprising that his crystal ball was pretty cloudy.

GALLOWS HUMOR

For some odd reason the FCC decided to set up an exhibit at the convention in Reston, VA, in September. The exhibit arrived in three huge packing crates stenciled "Property of the FCC," to which someone had added to one of them, "Repeater Rules, Box one of three."

FILING REPEATER MODS

You may be able to save a year or more on getting modifications to your repeater license accepted if you remember that the intention of the Walkergroup is to throw out your old application forms and replace them with the new ones. So make sure that you essentially resubmit your whole

filing with each modification, whether it be for a different antenna, a change in type of coax or length of coax to the antenna, location of the repeater (Walker refuses to officially establish an interpretation of the rules on this, so even a one foot move of the antenna could call for a modified license), means of control, power, etc.

SOMETHING TO TALK ABOUT!

Though one would be hard put to discover this from a casual tune around the amateur bands, there actually are other things to talk about than signal reports, the equipment being used to talk about the equipment, and the weather.

For instance there are wonderful possibilities in the newer FCC regulations and the proposed changes in rules. Many operators need a dozen or two good contacts to build up the level of outrage needed to properly answer the FCC's proposal to open a new citizen's band. This is so preposterous that many of us tend to just try and ignore it – like some terrible calamity that we refuse to really face. Perhaps if we talk about these things over the air a bit they will become real enough so we can sit down and do them justice in our comments to the Commission.

But there are other things to mull over too. Mutual indignation contacts are okay now and then, but they make a lousy steady diet.

Now, to get around to the point (for a change) – there are some pocketbooks around that are most fascinating and which have so much incredible data in them that you should be able to stop any roundtable flat in seconds. One of the best of the breed is a Dell book, "Mysteries From Forgotten Worlds," which is Dell 6214 and costs $1.25. Another excellent book of the gendre is, "We Are Not The First," Bantam Q7534, S1.25, by Tomas. If this begins to get to you, you may want to get back to the first of this series, books by Daniken, Bantam Q5753, S1.25, "Chariots of the Gods?" – which was featured in the television special "In Search of Ancient Astronauts," and Bantam Q7276, $1.25, "Gods From Outer Space."

These books introduce you to interpretations of ancient texts and archaeological findings which suggest strongly that there may have been some previous civilizations that were quite a bit more advanced than we have hitherto suspected.

One example which several of the books discuss is the Piri Reis maps, recently discovered in the Topkapi musuem in Istanbul, and which apparently were copied from maps that Columbus used on his trip – which were in turn copied from much earlier maps. The interesting thing is that the maps show the Americas in good detail, including remote reaches of South American rivers – and, most astounding of all, the Antarctic continent is shown correctly as it would be without the layer of ice which is thousands of feet deep!

By way of a short check on the material in the books above, I called Father Lineham W1HWK, the head of the Weston Observatory and an old friend, to ask him about the Reis maps. He had worked with them a few years back and was quite familiar with them. He substantiated that the maps did indeed show Antarctica as it would be without the ice coverage – and he pointed out that the ice is not hundreds of years old, as reported in books, but is millions of years old.

The Father pointed out that the Reis maps show Greenland as three separate islands, a fact only recently discovered by echo sounding of the millions of years old icecap. He also affirmed that there is good reason to believe that Columbus had indeed used predecessors of the Reis map.

If the other reports in the books are even half as accurate as the Reis map story, then there is a lot to think about. It would only spoil it for you to tell you about discoveries of 2000 year old batteries, an intricate computer of about the same age, precise calculations of the circumference of the earth dated 300 BC, and things like that. Have fun – and start boggling minds on the air a bit.

RECENT CONVENTIONS

The *Hamburg* Hamfest was a real winner this year – the manufacturers who exhibited there got all the attention they could ask – and then some. Watch out for an even bigger affair next year – and don't pass up this new and growing hamfest. It is a fact that you'll get better treatment here and more personal attention than at any other hamfest.

Dayton is going a full weekend in 1974 – and that's great news. The committee expects that they may pull in over 8000 this time, setting an all–time record. Dayton has the largest exhibition area – the largest flea market – the largest attendance.

Hyannis came off about as predicted. The Saturday turnout was a little thin, but Sunday was better than in the past and made up a bit for it. The exhibit area irritated a lot of the exhibitors – troubles with getting power – trouble with lights – trouble in bad locations of booths – trouble finding anyone to help with problems – exhorbitant storage fees for boxes shipped ahead – things like that. Distributors were disappointed as few amateurs appeared to have brought any money – there seems to be some problem with this. . .many of the staunch ARRL members apparently are not active hams and are uninterested in buying anything. Odd.

Reston Virginia was a frost according to reports. The turnout was very thin and exhibitors needed a deck of cards to keep busy. The high spot of the convention was a sign on one of the three huge crates that were part of the FCC exhibit, "Repeater Regulations, Box 1 of 3."

Saroc 1974 – is anyone going? Almost all the manufacturers we've talked with are planning on passing up this bomb.

MORE COUNTRIES?

Should contacts with a country count as long as we are certain that the station really is in the country claimed? ARRL has long had this thing about not accepting clandestine operation, even though there was no question about it being where claimed. I recall one instance wherein the League almost destroyed an Iron Curtain country ham by sending a card back to the officials asking if it were okay.

For instance – Turkey. At present there are a few hams there – and in recent years there has at times been a good deal of clandestine operation there, complete with QSL managers. Should these cards be counted for awards and certificates? What do you think?

FCC HEEL DRAGGING

A visiting foreign amateur managed to get a reciprocal license, but it took him three long months of hard work to get it through the FCC in Washington. Apparently the Commission is not only bogged down on repeater licenses, but on other apsects of amateur license processing too. If Walker would spend a little time trying to get his department moving and being constructive instead of making one hassle after another for us, ridiculous delays like this might be avoided.

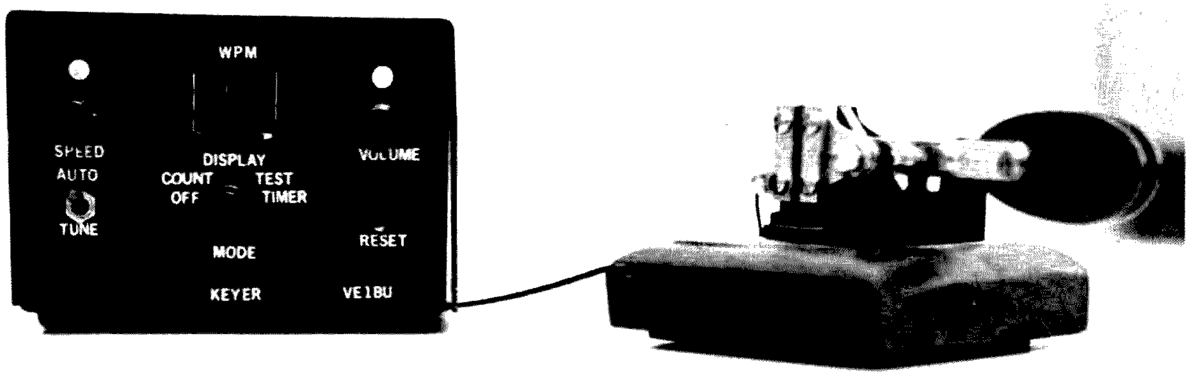
MORE SALES HELP

If you just look at the number of ads in this issue of 73 you can see why more people are needed in the 73 advertising department. We hope that there are one or two amateurs who might be interested in working at this. Sales experience is important, of course. Living in New Hampshire is great, so give us a call if you think you might be able to handle the job.

. . . WAYNE

CODE SPEED DISPLAY

Wilf Maillet VE1BU/W3
313 Summit Hall Road
Gaithersburg MD 20760



The first acquaintance with semiconductors for many hams came through the building of an electronic keyer. This gave the ham a chance to experiment and learn with a fairly simple and non-critical circuit. With the advent of integrated circuits (IC's), the same thing happened all over again. The natural circuit for application of these IC's for the ham was again the keyer. The first IC's were digital, either on or off and were easily adapted to the on/off characteristic of code.

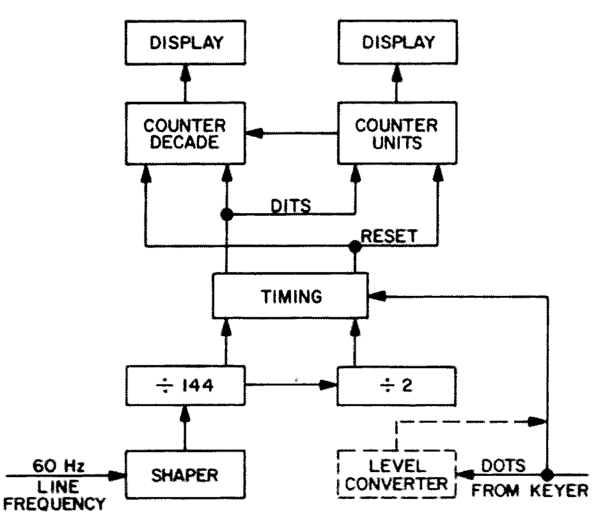


Fig. 1. Block diagram of the code speed display.

Now that many hams have a keyer, it may be time to add an extra goodie to it. This article describes a circuit made up of a few IC's that displays your sending speed in words per minute. Halfway between a speed marked 5 and 15 on your keyer, never did mean 10 wpm. Now you can really know your sending speed and impress the neighbors with this new gadget in your ham shack.

Block Diagram

The ARRL Handbook gives a formula for calculating code speed.

$$\text{Speed (wpm)} = \frac{\text{dots/min.}}{25}$$

or Speed (wpm) = dots/2.4 sec.

the timing is the 60Hz from the ac line. A filament transformer steps down the voltage and the shaper prevents the noise that may be present on the ac line from producing false trigger pulses. The 60 Hz is then divided by 144 which yields a pulse each 2.4 seconds. This pulse goes to a flip–flop which develops a positive pulse for 2.4 seconds. The positive pulse enables a gate which lets dots to the counter. The timing circuit also resets the counter and enables the circuit to operate without manual reset. The counter is made up of two decode counters which enable it to count to 99. The decode counter outputs go to a binary coded decimal (BCD) to seven segment decoder which in turn drives the display.

This description will give those with a knowledge of digital circuit techniques sufficient ideas to get going and build the circuit with their own variation of components. However, for those without too much experience, the design will be reviewed.

Circuit Description

Fig. 2 is the schematic of the code display unit. The shaper uses a Fairchild 9602 single shot. When pin 4 receives a voltage greater than 1.2 but less than 5V, a pulse appears at pin 6. The width of the pulse at pin 6 is determined by the RC combination. With pin 7 fed back to pin 5, the single shot is inhibited from putting out another pulse even with noise on the line, until the pulse at pin 7 has gone away.

The period of the incoming line frequency is 16.6 milliseconds. The RC time constant was chosen to produce a pulse at pin 6 equal to 12 ms, this will insure that the

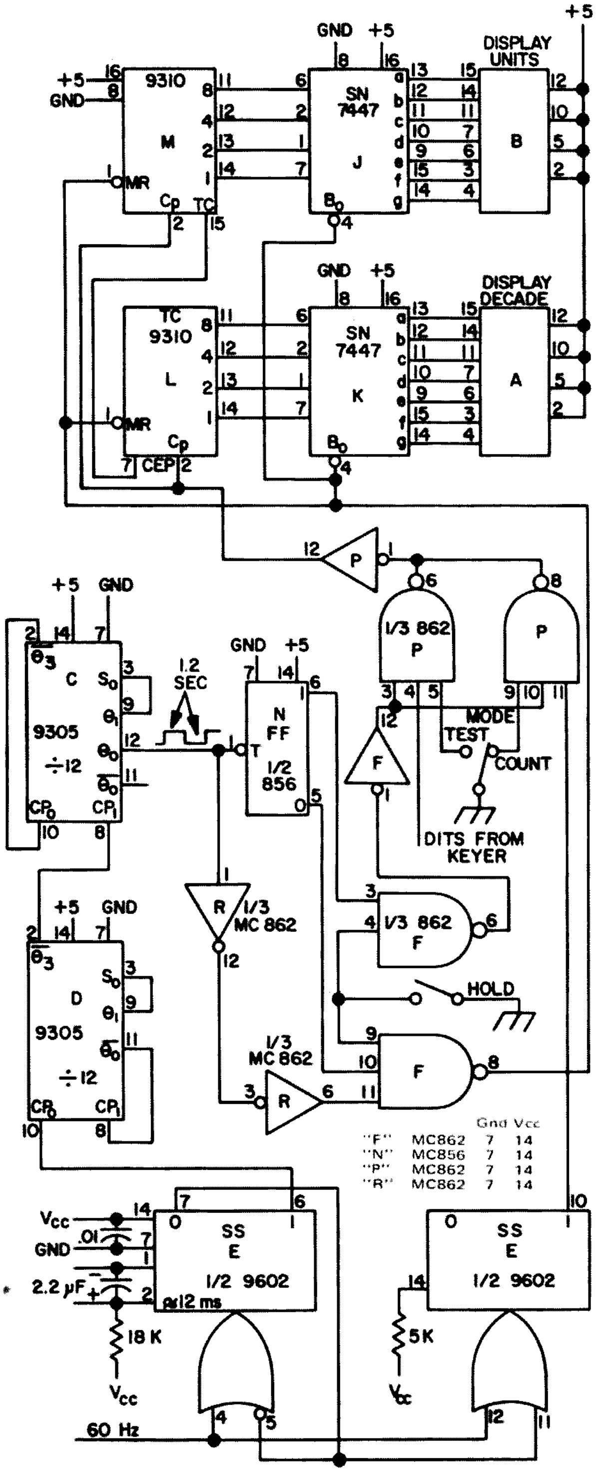


Fig. 2. Schematic of the display.

Consequently, if we can develop a pulse precisely 2.4 seconds long, and use this pulse to let dots from the keyer count-up a counter, then display the contents of the counter, we will have accomplished our goal.

A block diagram of the code speed display unit is shown in Fig.1. The source of

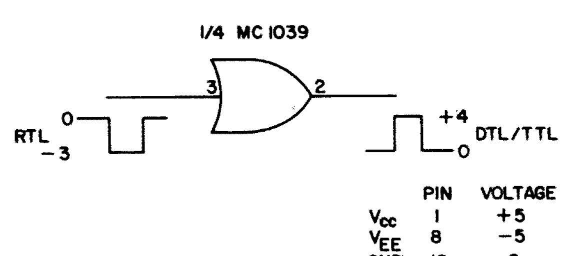
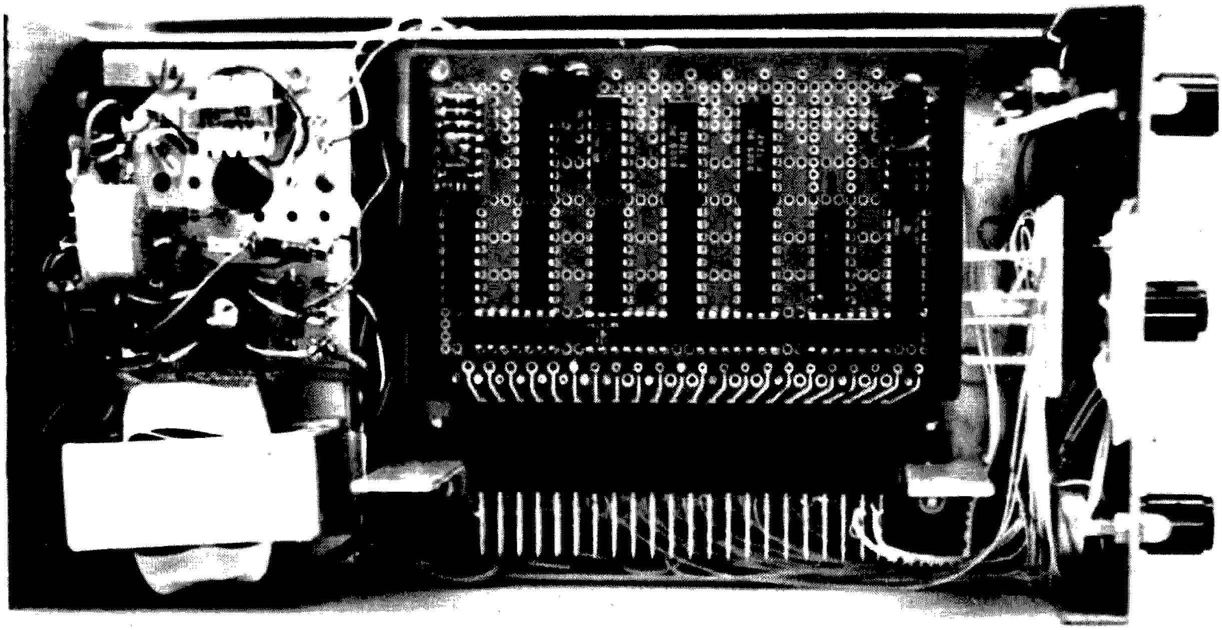


Fig. 3. RTL to DTL/TTL Converter.



Top view of the code speed display that was incorporated into the author's keyer.

pulse has gone away by the time the next ac line cycle appears. The shaper therefore, puts out a 12 ms pulse for each cycle of the ac line. When making a voltage divider for the filament transformer, use peak voltage for the calculation to inusre that voltage peaks at the shaper input never exceeds 5V. The pulses on pin 7 will be the same as those on pin 6 only inverted in phase.

Divider

The Fairchild 9305 IC can be wired to divide by various numbers, the IC's used in this application are wired to divide by 12. Hence two such circuits divide the incoming line frequency by 144, which results in a pulse at pin 12 of IC "C" each 2.4 seconds. This pulse train goes to pin 1 of Flip-Flop "N" to yield a pulse at pin 6 of "N" which is positive for 2.4 seconds and negative for 2.4 seconds. The same inverted sequence appears at pin 5 of "N." With the Hold switch open as shown, the 2.4 second pulse appears at the output of inverter "F" pin 12. We now have the 2.4 second gating pulse at "P" pin 3 and 10. With the switch in the COUNT Position, dots from the keyer pass through the gate during the 2.4 seconds and cause the units and decode counters to count the dots. The number contained in the counters is then decoded by the J and K IC's to drive the seven segmented display. After displaying the wpm for 1.2 seconds, the counters are reset and the cycle begins over again. Once the count has been made and displayed, it may be held by closing the HOLD switch. With the HOLD switch closed, the gating pulse and reset pulse are blocked and the display remains constant.

Test

This circuit contains a built in test feature which is an asset for those who lack the necessary test equipment. With the HOLD switch open and the MODE switch in the TEST position, the line frequency pulses from single shop "E" pin 10 are steered to the counters for a period of 2.4 seconds. These pulses substitute for the dots. There

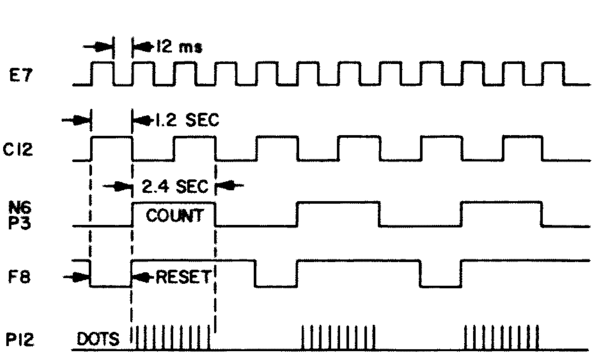


Fig. 4. Timing.

are 144 line frequency pulses per 2.4 seconds. Therefore, when the gate is enabled for 2.4 seconds, 144 pulses will enter the counters. The counters are only capable of counting up to 99, then they go to zero and continue to count incoming pulses. In this case, the counters will overflow and display 44. Consequently, a count of 44 in the TEST MODE indicates a good working unit.

Logic Levels

This unit is made up of TTL and DTL logic families. These logic families require positive (0 to 5V) input levels with a threshold of about 1.2V when the logic switches. Many keyers have been made using the RTL logic family. If your keyer is of this family and developes pulses which go from 0 to around -3V the above circuit will not work. Don't despair, with one more IC the 0 to −3V pulse can be converted to a respectable 0 to 5V pulse. The circuit for this level conversion is shown in Fig. 3.

Timing

Fig. 4 gives all the timing for the code speed display unit. The reset pulse comes just before the count begins. Evidence of the reset pulse can be seen since it blanks the displays during the reset period.

Power Supply

A word of caution to those who would rob power from their keyer to power the code speed display unit. This circuit requires 400 mA at 5V, so make sure your existing supply can handle this new load. If it can't, you can build the one shown in Fig. 5.

Operation

The best way to set your desired code speed is to adjust the speed with the

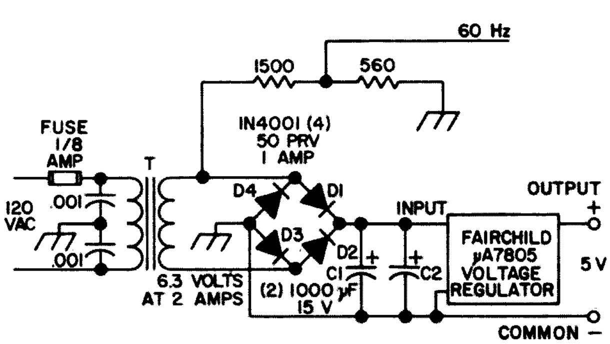


Fig. 5. 5 Volt Power Supply.

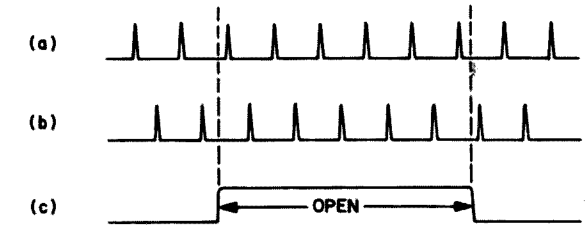


Fig. 6. Gating Error.

transmitter off (no rf) then switch to HOLD and continuously display the wpm until you want to make another code speed change.

One thing to remember when using digital counters, whether it be this one or a frequency counter, is that the least significant bit may be incorrect by one unit. Since the opening and closing of the count gate is rarely synchronized with the dots passing through the gate, there always exists a ±1 count gating error. In Fig. 6, line (c) represents the opening of the signal gate. If the phase relationship of the incoming dots with respect to the gate is as shown in (a), six pulses will be counted. If, however, the phase relation is as shown in (b) only five pulses will get through the open count gate. If the dots from your keyer were derived from the line frequency, this would not occur.

Conclusion

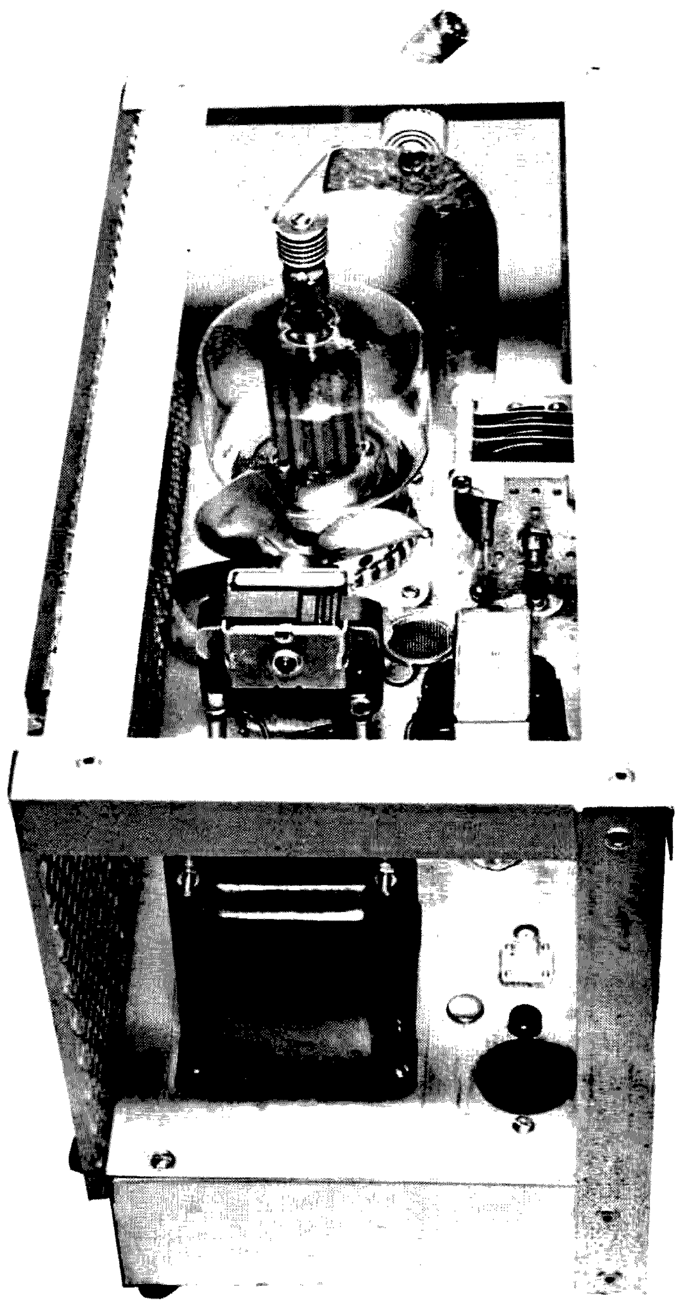
Although a specific design was presented, the main objective was to present a way of measuring and displaying code speed. It is not important to use the same IC's as presented here to arrive at the same results. Any IC's may be used that can fulfill the requirements of the block diagram. All IC's and display units to implement the block diagram are available from advertisers in this magazine.

No specific information was given regarding the lighted display units, because each type has its own connection outline. It is only required that "a" thru "g" of the SN7447A go to the corresponding segments of your choosen display unit.

The photos show additional circuitry to that described here, that is because I incorporated the keyer. I also took advantage of the 2.4 second pulse and divided it down to make a 10 minute timer.

...VE1BU/W3

Ralph W. Campbell W4KAE
316 Mariemont Drive
Lexington KY 40505



KILOWATT LINEAR AMPLIFIER FOR 2 METERS

The 5-500A plate line is a Mylar wrapped "sandwich" of silver-plated brass sheet metal and bronze foil. By using dual plate line construction, inductance is halved and skin-effect reduced. The aluminum angle case structure is part if the rf output circuit! A stub and 90 high power quadrature coupler must be used to separate chassis ground from output "ground" on cables.

Wanting a full kilowatt linear amplifier for two meter moonbounce attempts prompted me to construct the unit described. It is a linear built around the Eimac 5-500A pentode, with special tuning and mechanical features to allow safe operation above 110 MHz. Both transverse and bottom seal cooling is employed; however, for IVS or double sideband, only natural seal cooling is necessary – with the exception of the plate seal which must always be blown.

I must admit I had difficulty keeping a good tube going within the linear because of high-duty factor operation, i.e., AM linear

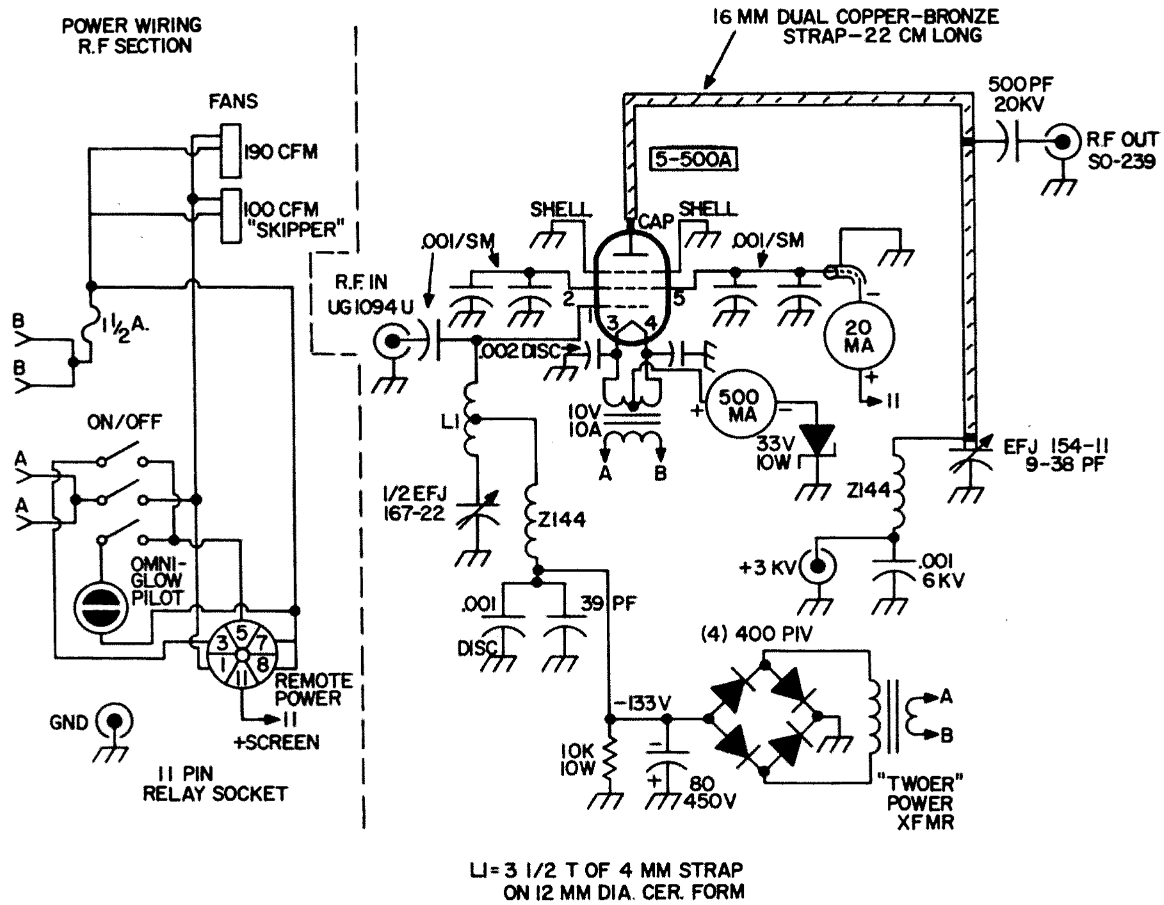


Fig.1. Schematic of the 1 kW 2 meter amplifier. Refer to the photographs for component placement.

and slow CW, and it was necessary to purchase an extra tube while experimenting. The first tube failed externally by arcing within the 5-500A base/shell, but there was no internal damage. After this I tried increasing the airspace around the socket (there was no room for an air system socket) and installation of a "whoosh-type" muffin fan blower on the bottom cover, directed at the socket. This last arrangement is the most satisfactory for AM linear operation.

The basic electrical design is similar to conventional tetrode linears, with the exception that an extra grid – a suppressor – is employed in the tube design. This grid is attached to the outer mounting shell/rim of the tube base and is grounded by an Amperex UHF plate type connector. Input circuit design utilizes an "inductive" divider, which means it is a series tuned network in parallel with the input coaxial connector jack; however, the divider action is a result of tapping total series grid inductance similar to an rf autotransformer. In the theory section we shall describe this further.

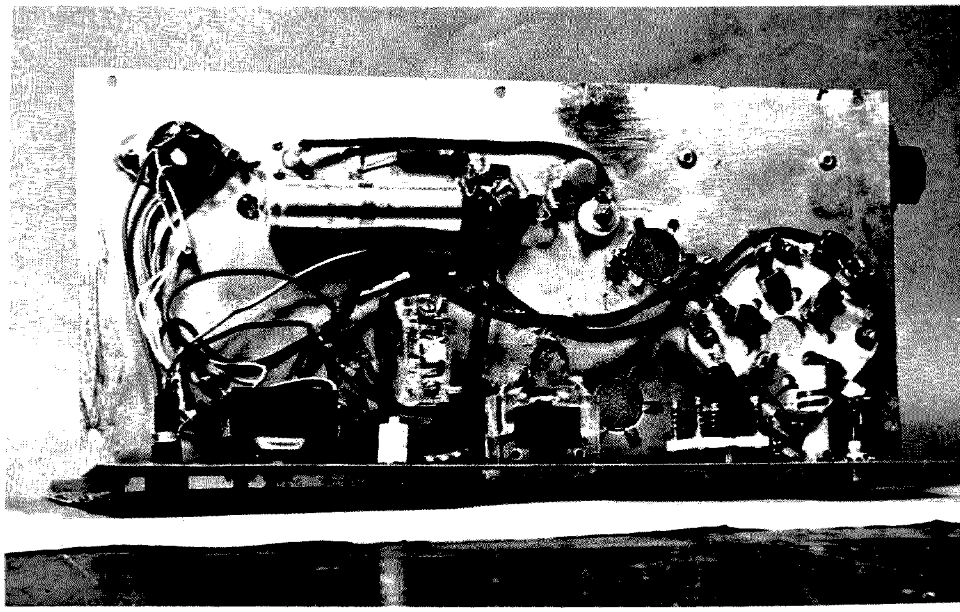
Choice of a pentode for VHF linear service was the result of an original study I made into the shortcomings of beam tetrodes on VHF: There seemed to be so many reasons why a tetrode rig could be unstable, or need neutralization or suffer from secondary emission, that I gave up long ago on these tubes for ordinary 50 or 145 MHz operation. On 500 MHz or 432, the 4CX-series of tubes are excellent. A better VHF *ceramic* pentode is the 5CX1500, but I didn't have the money to experiment with this tube.

Although I was not successful in working moonbounce with the linear described, it was operated during an ARRL VHF QSO Party with excellent reports!

Theory

Graphs describing operation for a particular operating class are not provided here

Under chassis view of the Amplifier. Screen bypass capacitors must be silver mica, or rf will eat 'em up in seconds! It may be hard to find these rated to 1000V, but they are available as CM07 types. Inductive divider input circuit is used, with slug removed from form. Tube base and socket pins should be separately blown by muffin fan from bottom for high duty operation.



because it would make the text too long. However, those wishing to do an analysis are directed to do so with the Eimac tube performance counter, as supplied with their text: *"The Care and Feeding of Power Grid Tubes."* I have already done such an analysis on a pair of PL-177WA's. The class of operation here is AB_2, depending upon how hard the unit is driven and how much distortion is tolerable. A set of operating parameters is enclosed as a reference.

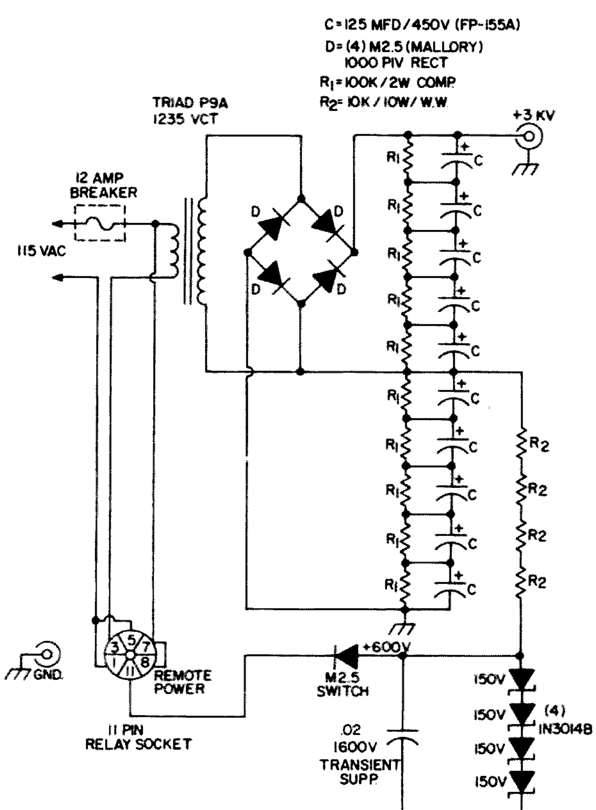


Fig. 2. Power supply for the 2 meter amplifier.

5-500A Specifications

Plate Volts	4000 (3000)
Plate Current	0.45 (0.33)
Plate Diss.	500
Screen Diss.	35 (16)
Drive Power	7 (5[estimated])
Filament	10V/10A
Screen	750 (600)

As can be easily seen, our 5-500A was operated well within its maximum ratings, noting that the maximum voltages and currents are at the left in each column and parentheses contain our figures. Bias, of course, is very important. We run about -133 fixed bias plus -33 zener bias off the centertap of the filament transformer, for about -165V or so total. There must be some grid current drawn, also, but it is very slight and impossible to measure bias attributed to it under key-down conditions. My TX-62 will drive the 5-500A to its highest power. Screen current is 10 mA or less, which is a conservative value. High circulating rf currents have been responsible for some of our troubles – high enough to melt the solder tabs even when the whole arrangement is transverse blown.

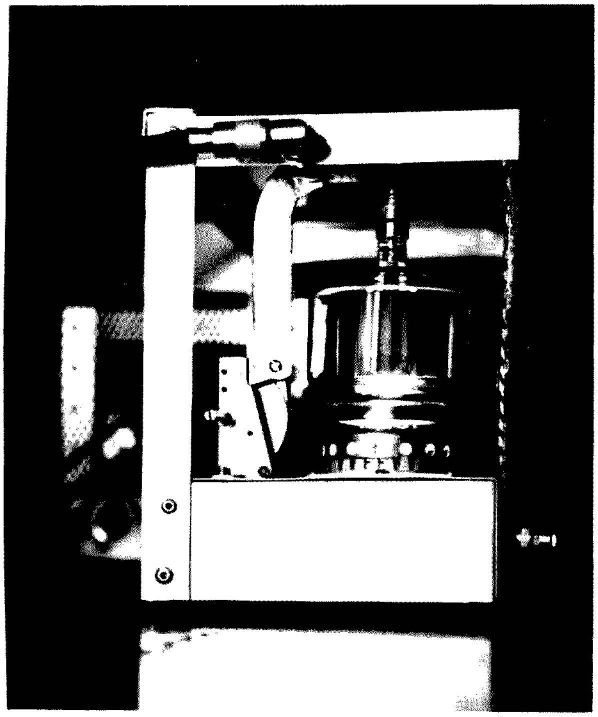
A limiting factor in VHF design is the high output capacity. On 2, it is necessary to series tune the plate tank, thereby providing an rf plate current maxima at the point where the strap comes closest to the sup-

porting structure. This is the precise point where a blocking/coupling capacitor is installed. The strap consists of both the teflon sandwich and stator capacitor blades *and* the plate lead-length *inside* the tube as well. Another factor that can be limiting in the usual designs is the input capacity. Not here, however!

Power output of the 1 kW 2m linear is up to five times that of our reliable PL-177WA's, operated in parallel, We're getting 500W on our diode indicator, which was checked against a Bird Thru-Line Directional Wattmeter. The way this indicator (using a hot-carrier diode) was calibrated, under matched conditions, is this: With the 177's having a measured output of 100W rf, the diode indicator was placed in series and the meter reading noticed. Then, I wrote down 20 out of a full scale value of 50 units. With the bigger 5-500A linear and the exact same load in-circuit, the reading was 45 units most of the time and 50 units (and slightly off scale) when there was higher ac line voltage, as in the afternoon for instance.

Construction

The 1 kW 2m linear is built in a Bud Converta-Box chassis. Plexiglas is used for safety-of-life considerations, since metallic screening on only the front apron can be tolerated. Seems there's a cavity type rf mode within the enclosure, which can be quickly destroyed by placing any metallic screening on the other surfaces. The P-6461 Stancor filament transformer is mounted on the Converta-Box and not in the separate power supply. Also, there's the Barber-Coleman transverse cooling fan adjacent to it. An air system socket would have been used had Eimac thought to provide a suitable grounding strap on the SK-400. Separation was added later, to permit adequate air flow for cooling the base seals. The transformer next to the fan is a Heathkit "Twoer" power transformer used in the bias supply. The coaxial HV jack is rated to 5 kV and is featured for greater safety as well as a good ground between the supply and top deck of the box. A second ground is provided by means of a banana-jack plug next to the 11 pin relay socket which supplies low voltage, power and screen voltage to the unit.



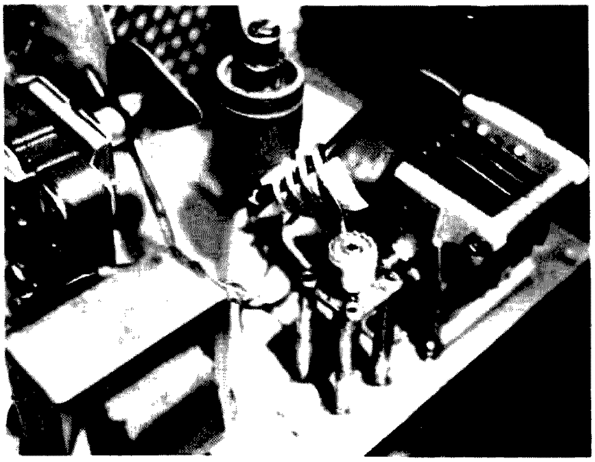
Ambient light side view. Open case partitions are covered with Plexiglas, to prevent improper loading which would result with screening. Top channel cannot be "grounded" to lower chassis without loss of several hundred watts of output power. Amperex S-3706 suppressor ground connector is visible. Entire unit is built upon large Bud Converta-Box. Angle plug was replaced with Tee connector for addition of stub.

A Sprague 20DKT5 500 pF/20 kV ceramic coupling capcitor is mounted upon the sandwiched teflon plate line. At the point where the screw secures the "door-knob" to the line there is a juncture between the split-silver plated bronze (to the left) and the heavier soft brass dog-leg down to the EJF type 154-11 "E" capacitor. This variable has a range of 9 to 38 pF, which is just right to tune different variations in tube output capacities with the sandwich strap. The strap is a high efficiency ¼ wavelength tuned line, and not ½ wave. Even so there is a "cavity effect" within the enclosure.

The front apron controls are: Input, Grid, Quiescent Cathode Current, 30000V (neon lamp pilot), ON/OFF and Fuse. The input connector is an Amphenol UG-1094/U and the "grid" control is an EFJ butterly "L" capacitor, type 167-22. Only one half section is used. The cathode meter is an Emico Edgewise 500 mA plastic encased economy model. The ON/OFF switch is a Cutler-Hammer industrial 3-pole job with a high

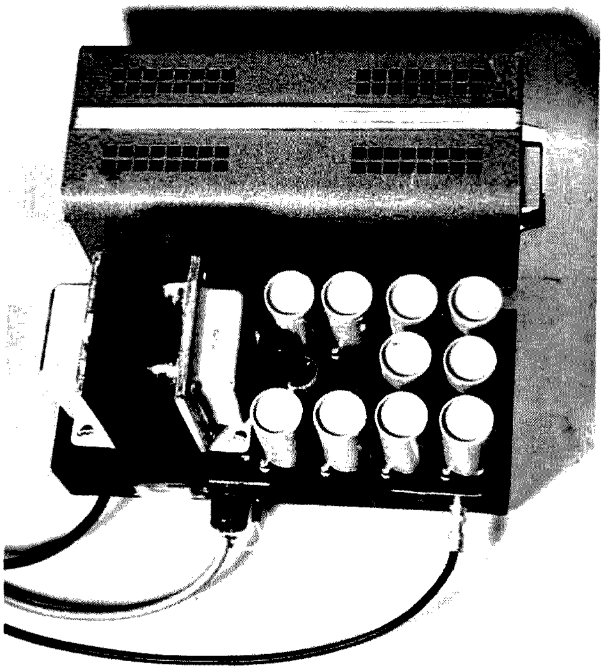
current rating. The fuse is a 2A Slo-Blo. The underside of the chassis shows routine components, a bridge rectifier plus filter and sockets.

The high voltage power supply is housed in a separate container. We chose a standard Par-Metal amplifier foundation measuring 6 x 14 x 3 (inches). Topside there's the Triad P-9A 1235V CT power transformer, some teflon "zener sink" stud cups, and an extensive bank of Mallory electrolytics. Each electrolytic is mounted separately with its own 100K/2W voltage equalizing resistor and ceramic posts which are bolted to the chassis proper. Oversize holes are drilled in the foundation to give high voltage lead clearance therethrough. The zener sink cups are actually portions of teflon C-cell battery tubing that have been cut off about 1 cm high, then they are filled with Wakefield type 142 thermal epoxy to make a good sink to chassis when the resin is cured. I tried the mica-insert-stud method of sinking the zeners, but when you series as many as four 150V units, the insulation is insufficient. The solution to the problem was to insulate the studs with fiber shoulder washers and encapsulate as shown. Only one P9A power transformer is shown for IVS service. Two are necessary for AM linear and prolonged CW uses.



Closeup of earlier coupling arrangement, discarded because of rf arcing through teflon insulation and shrinktubing. We bad to change different output scheme to make it work properly. On 145 MHz a strap is a "tuned" circuit with 5-500A (high) output capacity. Only about 300W output with type loading. Current maximum must occur at output coupling point. Inductive coupling like this is no good.

An underchassis view of the power supply shows the Vectorboard silicon rectifier wiring and connections to the transformer leads and relay socket. A 12A circuit breaker is shown on the left. Sixteen Mallory M2.5 rectifiers are cascaded in rows of four each, for higher PIV. No equalizing resistors or capacitors are necessary on these devices since they are avalanche rectifiers, rated at 1 kV/2.5A each! There is another Emico meter shown, which used to measure the voltage drop across the 10K series droppers, but this was abandoned when the knee of the series-string resulted in the right screen voltage. A series M2.5 rectifier is used as a polarity sensitive switch, to prevent tube failures that result in destruction of the zener supply.A high voltage buffer capacitor is used across the screen regulator circuit to prevent transients from blowing these devices.



2KW power supply for the Linear. Four 10W stud mounted zeners are cooled by pools of cured Wakefield thermal epoxy, which is applied to the chassis. Electrolytics are mounted on 3/8th inch ceramic posts for high voltage insulation. Two Triad P9A plate transformers are necessary for CW or AM linear operation, although, the one shown here will do for SSB or DSB service.

Adjustment

This linear isn't really tricky to use. All that's necessary is to have some kind of indicator attached to the output connector (an swr bridge is fine here) and adjust the grid for a resonant peak and resulting increase in plate current. There should also be a resulting increase in signal output. If plate current rises too high, meaning an out-of-resonance tank, reduce the driver power to allow resonance to be reached without damage to the tube. By peaking the plate tank for highest output, which may or may not accompany a dip in line current, proper operation is achieved. A dummy load should be connected at all times.

The adjustments mentioned above should be repeated until maximum output readings are obtained. If a Heath Cantenna is used for a load, it should be operated for only a few minutes becuase of high rf output. A quick check should be made after these adjustments to ensure screen current and plate current meters are indicating safe values. Of course the best way to get an overall picture is to look at the 500W anode – if it is glowing a dully cheery red, you're probably all okay.

The external stub shown is a necessity for a perfect match on two meters, although there may be some installations that don't require it. This is made from a piece of open-circuited RG-8/U cable, exactly 21.60 cm long – from the back shoulder of a PL-259 plug – to the open end. The purpose of the stub is *not* to eliminate standing waves on the outside of the cable; rather it is for matching impedance of the inner conductor to resonant plate load impedance of the tube.

Conclusion

The 5-500A linear amplifer, or "1 kW 2m Linear," is a big help on 2. With up to 500W output from a mere grid drive of about 5W, is 20 dB gain that any transmitter can use – especially when the band is less active during low-bending VHF activity (the ionosphere does affect stratospheric bending). I have had no more problems with Hi-Fi interference than with the TX-62 that drives it, so once you alleviate problems caused by the TX-62 you should have no further difficulty operating this equipment!

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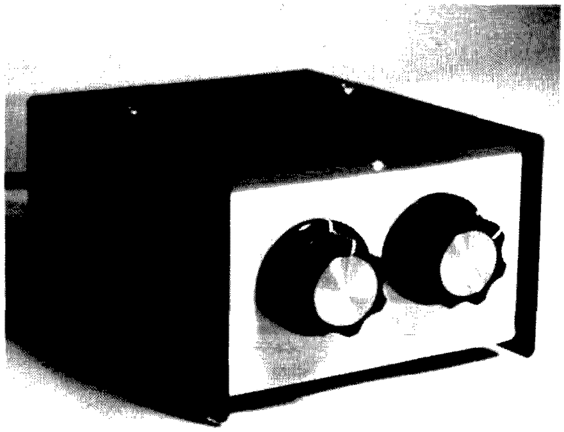

A SIMPLE IC KEYER

Here is an electronic keyer that features self-completing, built-in monitor and instant start. The bulk of the circuit is straightforward, using gating and flip-flop functions to generate dots and dashes. The really unique aspect of the keyer is the gated clock.

The gating action of the clock must operate in the following sequence. The clock is enabled by either the paddle or the output which is the method of self completing. When the output goes low after the completion of a dot or dash and the paddle is not depressed the clock is disabled, and must remain disabled for at least one dot time duration, after which it should be able to start on demand. This provides a minimum spacing between dots and dashes regardless of the motion of the paddle.

The oscillator uses a SN7413 Schmitt trigger as a relaxation oscillator. Typical waveforms appear in Fig. 2.

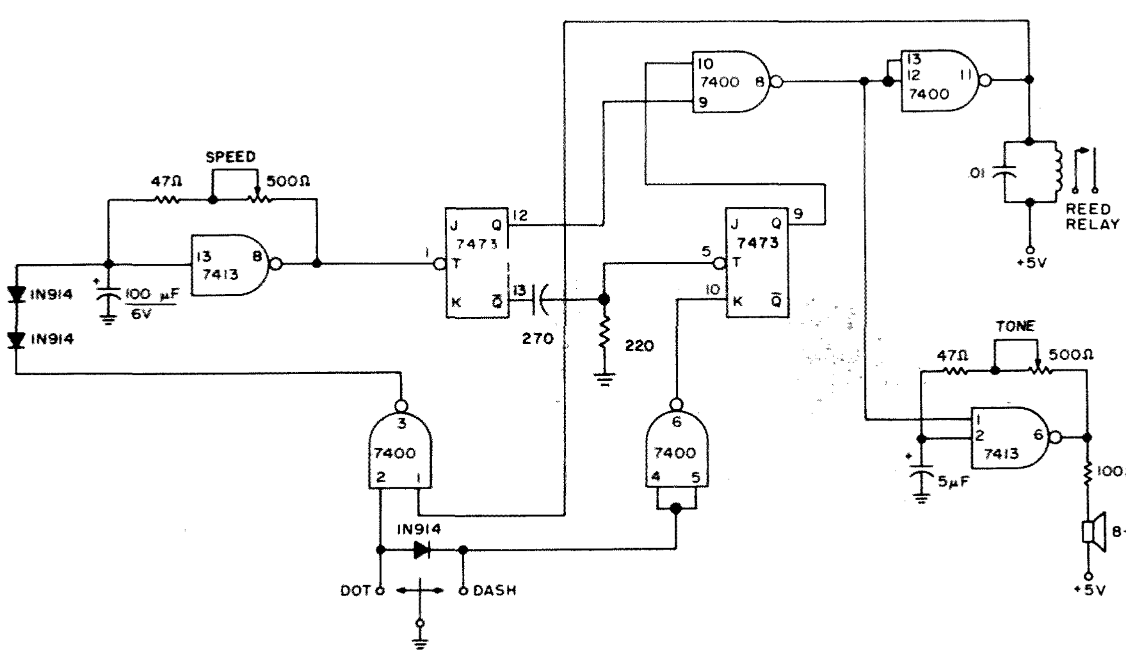

Fig. 1. Schematic diagram of the keyer.

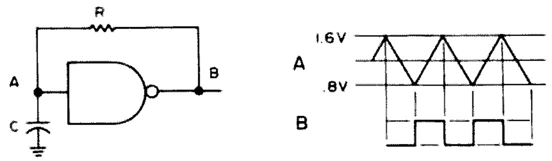

Fig. 2. Relaxation oscillator and associated waveforms.

These criteria require a control signal to disable the clock, prevent any negative transition for one dot duration and then be ready on demand. The circuit in Fig. 3 accomplishes this function with the minimum components.

When the control line is low the circuit oscillates normally. When the control line goes high, which in the keyer coincides with the negative transition of the clock, the diodes conduct and the capacitor voltage quickly discharges from 1.6 to about 1.5V, which is the sum of the "0" output voltage of the gate and the two .7V diode drops.

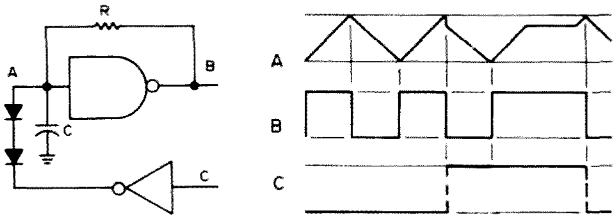

Fig. 3. Control circuit for the clock.

The capacitor continues to discharge at the usual rate until it reaches the SN7413's threshold of .8V, when the gate changes state and the capacitor voltage heads up again. The capacitor charges up to 1.5V and becomes clamped by the diodes. The oscillator is now ready for operation. When the control line goes low the capacitor can now charge up 100 mV to the threshold and begin oscillation.

The oscillation is not "instant" start, but "fast" start. Approximately 10% of a dot duration is required for start-up.

The unit is easy to build and careful shopping for surplus components can place the cost below $10.00 for everything, including cabinet and power supply.

...K2BLA

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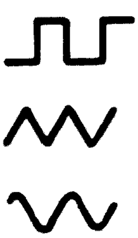
PRECISION WAVEFORM GENERATOR



All this from a single IC!

This article describes a compact signal generator that simultaneously outputs square, triangular, plus, unlike others, sine waves in the frequency range of 0.05 Hz to 1 MHz. Although the author's unit is a signal generator, it can be used as a frequency modulator or voltage controlled oscillator with only minor circuit modifications.

The signal generator utilizes the advanced Intersil 8038 monolithic chip which features:

- simultaneous sine, square and triangular wave outputs
- low distortion (1%)
- high linearity (0.1%)
- wide frequency variation (.001 Hz to 1 MHz)
- variable duty cycle (2% to 98%)

Typical amateur applications for this waveform generator are:

- RTTY AFSK Keyer
- FM modulator
- voltage controlled oscillator
- signal generator

Signal Generator Circuit

The heart of the signal generator is the Intersill 8038 waveform generator. The schematic diagram of Fig. 1, shows the author's circuit of a signal generator. This circuit consists of the waveform generator, timing capacitors and potentiomenters, and a dc coupled buffer amplifier. This amplifier is switched to the desired wave shape output. Three dedicated buffer amplifiers and output terminals may be used for additional flexibility.

Components

The timing capacitors C1 to C8 should be high Q, low tolerance components where possible. These capacitors determine the frequency decades of the signal generator. R1 serves for frequency tuning within each range, R2 determines the frequency coverage of R1, R3 and R4 limit the upper frequency of the ranges. A good quality linear taper potentiomenter with at least 270° taper function should be used for R1. Using a linear potentiometer for R1 the dial scale will be semi-logarithmic.

With the resistor and capacitor values as listed, the following frequency ranges are covered (R1, R2, R3 and R4 are adjusted to give a 600 to 6000 Ohm tuning range):

Capacitor	Frequency Coverage
C1, 500 μF	.05 Hz – .5 Hz
C2, 50 μF	.5 Hz – 5 Hz
C3, 55 μF	5 Hz – 50 Hz
C4, .5 μF	50 Hz – 500 Hz
C5, .05 μF	500 Hz – 5 kHz
C6, .005 μF	5 kHz – 50 kHz
C7, 500 pF	50 kHz – 500 kHz
C8, 250 pF	100 kHz – 1 MHz

If different values of capacitors or resistors are more convenient, the resulting frequency for different RC values may be calculated from the following formula:

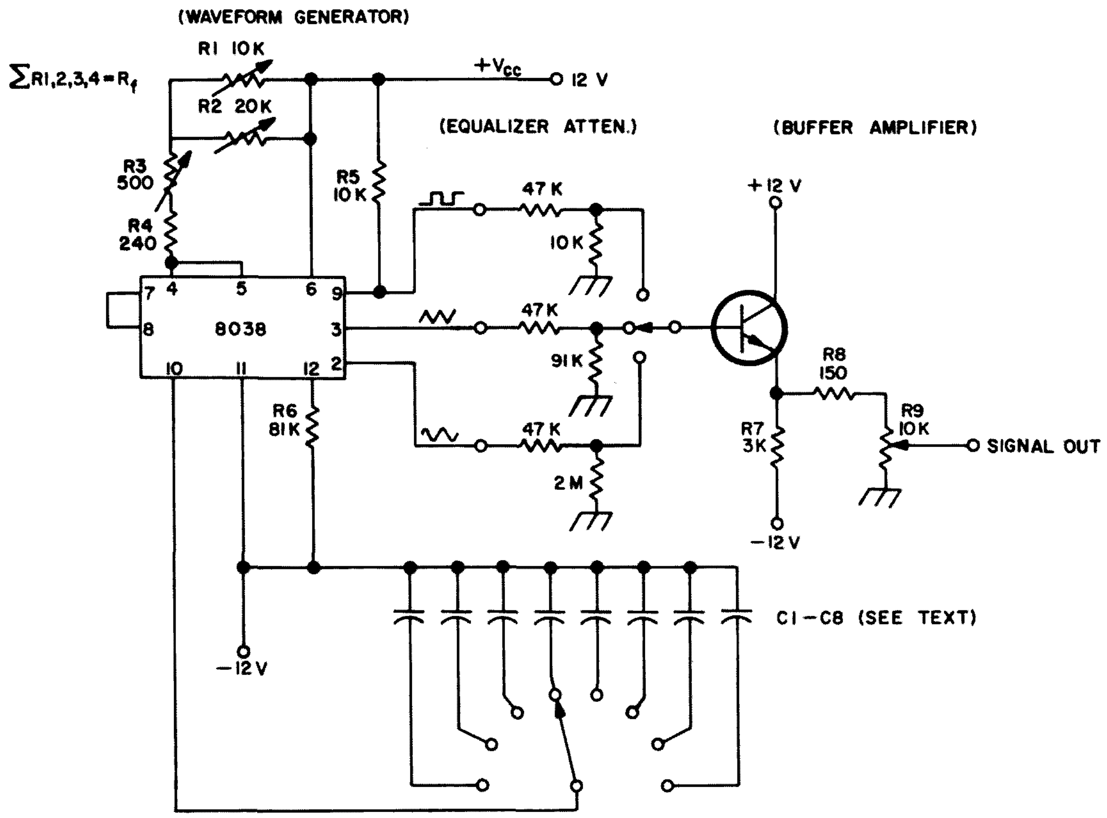


Fig. 1. Schematic of the triple-wave output signal generator.

$$F = \frac{150{,}000}{R \times C}$$

C is the timing capacitor in μF and R is the total resistance between +VCC and terminals 4 + 5 in Ohms.

The permissable resistance values between terminals 4, 5 and +VCC range from 250Ω to 500kΩ. The permissable supply voltage may vary from ±5V to ±15V and preferably should be regulated. A single supply of +10 to +30V may be used, but it is then advisable to decouple the output with a capacitor because of the large dc offset voltage. This will likely cut down on square wave and low frequency response.

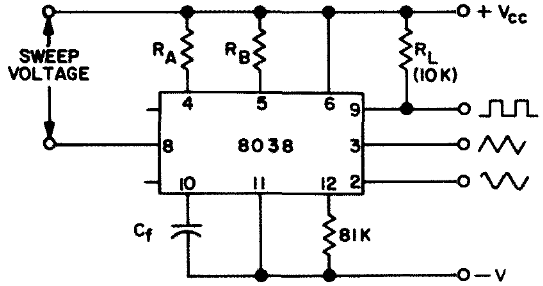


Fig. 2. Sweep circuit and voltage controlled oscillator.

The sine, square and triangular wave outputs at chip pins 2, 9 and 3 have different output levels. These levels are, (with a 100kΩ load resistor), 0.9 x Vs for the square wave, 0.3 x Vs for the triangular wave and 0.2 x Vs for the sine wave signal. (Vs = total supply voltage). Thus, with 24V supply voltage, the available output levels are 21V peak to peak (square wave), 7.5V peak to peak (triangular wave) and 5V peak to peak (sine wave). The square wave and triangular wave outputs are therefore attenuated to the same level as the sine wave output before going into the buffer amplifier.

Buffer Amplifier

A simple buffer amplifier is shown in Fig. 1. The resistor dividers provide equal signal levels to T1 and reduce the loading effect of the low base input impedance. T1 is a 2N3709 high gain amplifier transistor which is wired as an emitter follower to provide a lower output impedance than the 8038 chip. The signal level for all waveshapes at ±12V supply voltage is approximately 5V peak to peak.

CIRCUIT ALTERNATIVES

AFSK Generator

Because of it's high stability and low distortion the sine wave output is perfect for RTTY audio shift frequency keying. Two methods of frequency shifting are possible with this unit. The value of the frequency determining resistor may be switched, or a frequency shift voltage may be introduced to terminal 8 as indicated in Fig. 2. If the first of the two methods is used, typical values of Cf and Rf are (with Cf = .033 μF):

$R_f = 3135\ \Omega$
f = 1450 Hz mark frequency
$R_f = 2806\ \Omega$
f = 1620 Hz (170 Hz shift)
$R_f = 1976\ \Omega$
f = 2300 Hz (850 Hz shift)

Frequency Modulator

Fig. 3, shows a typical schematic for narrow band frequency modulation. The frequency of the waveform generator is a direct function of the dc voltage at terminal 8, measured from +VCC. By altering this voltage, frequency modulation is performed.

For small deviations of (e.g. 10%) the modulating signal can be supplied to pin 8 through a decoupling capacitor. An external resistor between pin 7 and 8 is not necessary but can be used to increase the input impedance, which then increases from 8kΩ to 8kΩ + R.

For larger FM deviations or frequency sweeping, the modulating voltage is applied between the positive supply voltage and pin 8. A 1000:1 sweep range can be achieved with a change of f = 0 at V sweep = OV. The potential at pin 8 may not exceed 2/3 of +VCC.

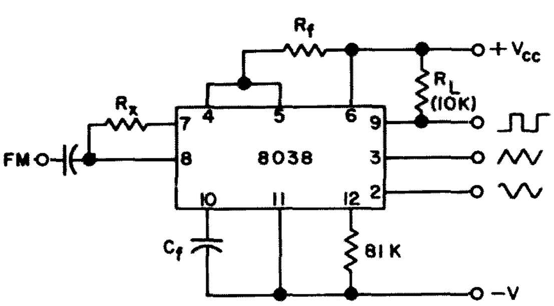


Fig. 3. Connections for frequency modulation.

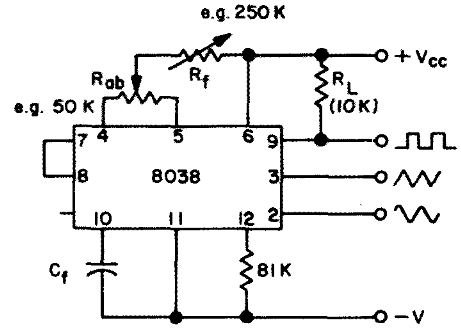


Fig. 4. Variable duty cycle oscillator.

A typical ham application would be to produce a frequency modulated (e.g., 455 kHz i-f) signal for mixing purposes. Another use for this circuit is the determination of filter bandpass curves by frequency wobbling.

Variable Duty Cycle Oscillator

If the timing resistor circuit (R1 through R4, Fig. 1) is changed as outlined in Fig. 4, the duty cycle of the output signals can be adjusted from 2% to 98%. Thus, a variable mark-space ratio square wave or a sawtooth shaped triangular wave can be generated. The frequency of a (360°) wave stays constant regardless of the position of R_{AB}. Rf permits about one decade of frequency adjustment without changing Cf.

Comments

After you build this signal generator the dial has to be calibrated. This work requires preferably a frequency counter. The high value timing capacitors (50 μF and 500 μF) were electrolytics, and my dial calibration was somewhat "out" on these 2 low frequency ranges. The wave outputs of the 8038 deteriorated slightly above 500 kHz.

The cost of the signal generator runs about $20. The Intersil 8038 function generator chip can be purchased for $5 in the U.S., $6.90 in Canada, in single quantities. What makes this unit so handy is that it – unlike the NE566 generator – outputs a sine wave signal also. It is a worthwhile piece of equipment for the homebrewer.

. . .VE3GSP

References: Intersil application note; 8038 waveform generator.

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HELICAL RESONATOR DESIGN

Selectivity cookbook for any frequency.

Helical resonators provide an excellent approach to filter design for the high and very high frequency ranges where high Q and reasonable shape and size are needed. Coaxial and strip line filters become unwieldy at the upper limits of the HF range and ferrites, in general, have lower Q at higher frequencies. In spite of several construction articles using helical filters, their design parameters have not been generally available for those with limited libraries. The following has been adpated from the excellent, but expensive, *Handbook of Filter Synthesis* by Anatol Zverev and from the original articles by Macalpine and Schidknecht.

The helical resonator consists of a coil containing roughly one quarter wavelength of wire enclosed in a shield and grounded to the shield at one end. Dimensions are calculated from L and C equations based upon the shape factor of the coil and size relative to the shield. This shape factor, once established, must be closely adhered to if degradation of Q is to be avoided. Those interested in derivation of the design equations should refer to the references cited.

Nomographs are often utilized for roughing out a design, formulas to fix the design, and trial and error for final adjustment. Figures 1 and 2 are unique in being the nonmovable portion of a slide rule. The sliding portion is constructed as follows: Set a sheet of paper with one edge at 1 on the frequency scale. Mark the frequency of interst and cut perpendicular to the scale. In the center near the word SQUARE or CIRCLE cut half way parallel to the frequency scale and fold. The slide will be similar to the dotted area of Fig. 1, which is constructed for 21 MHz. The lower edge should be set to the desired cross-section size, 4 centimeters in the example. Sizes D

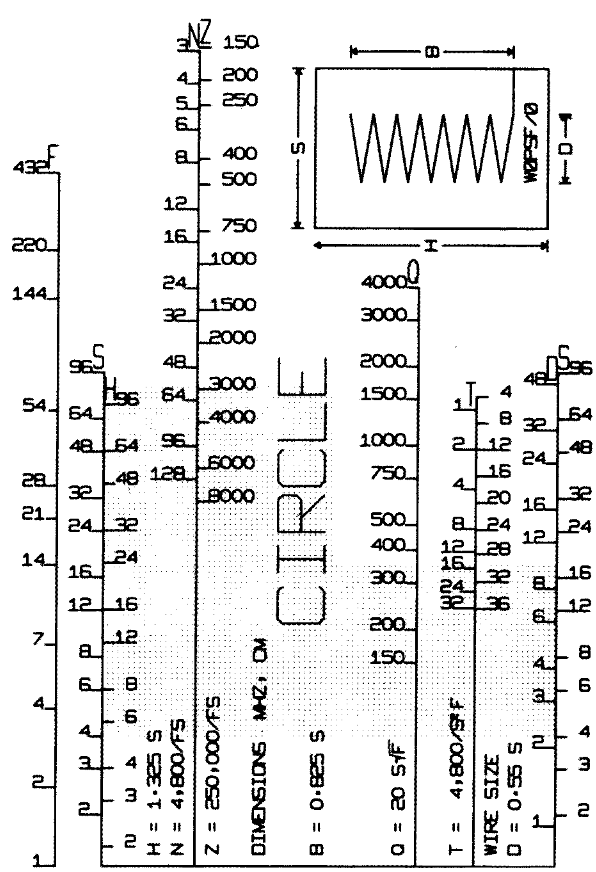

Fig. 1a. A reduced version of the nomograph on the next page showing the shape of the movable paper mask (shaded portion) used for determining helical resonator dimensions. A new mask must be made for each frequency band. The one shown is for 21 MHz.

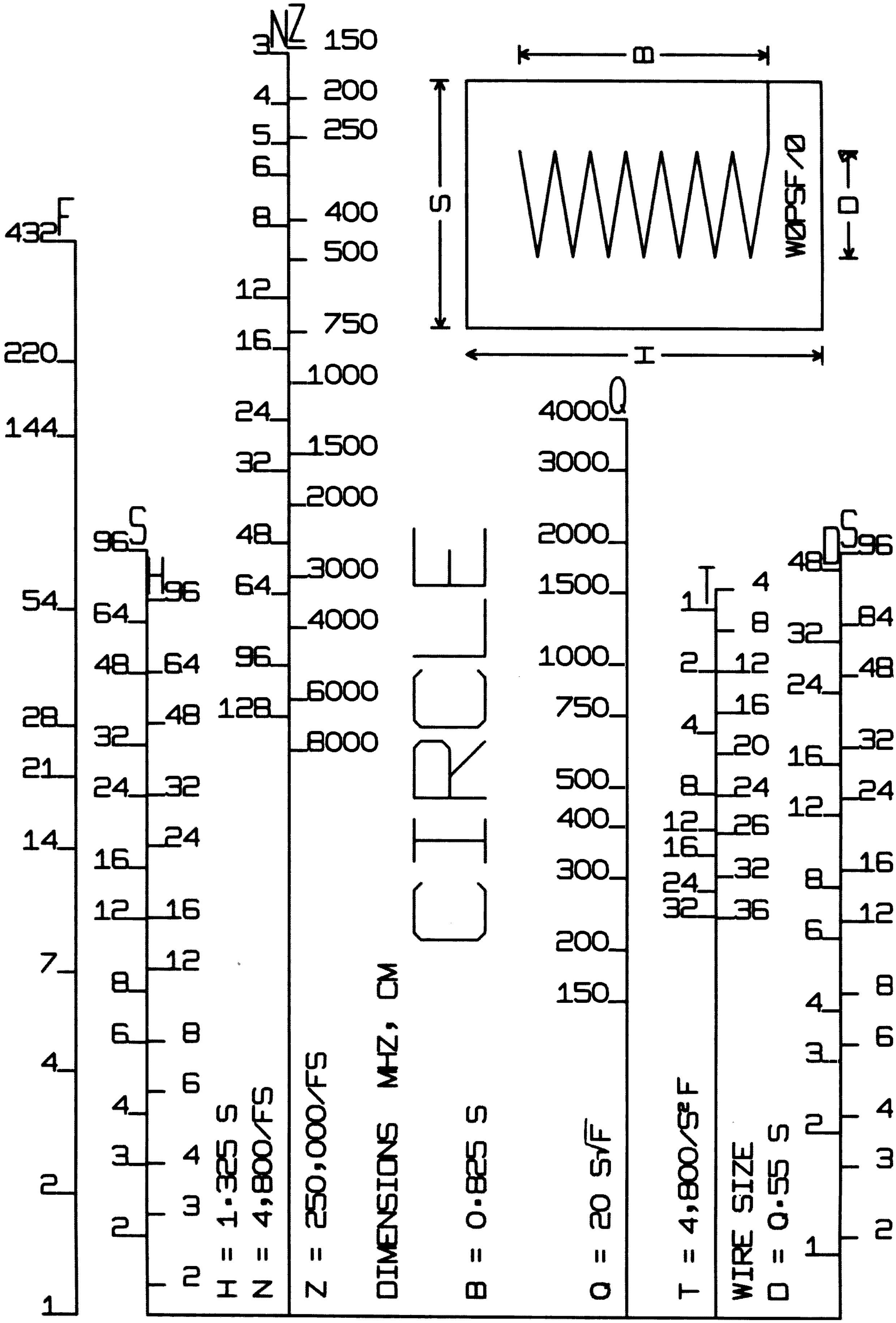

Fig. 1b. Nomograph for determining the dimensions of helical resonators in round shields. See text and Fig. 1a, for use.

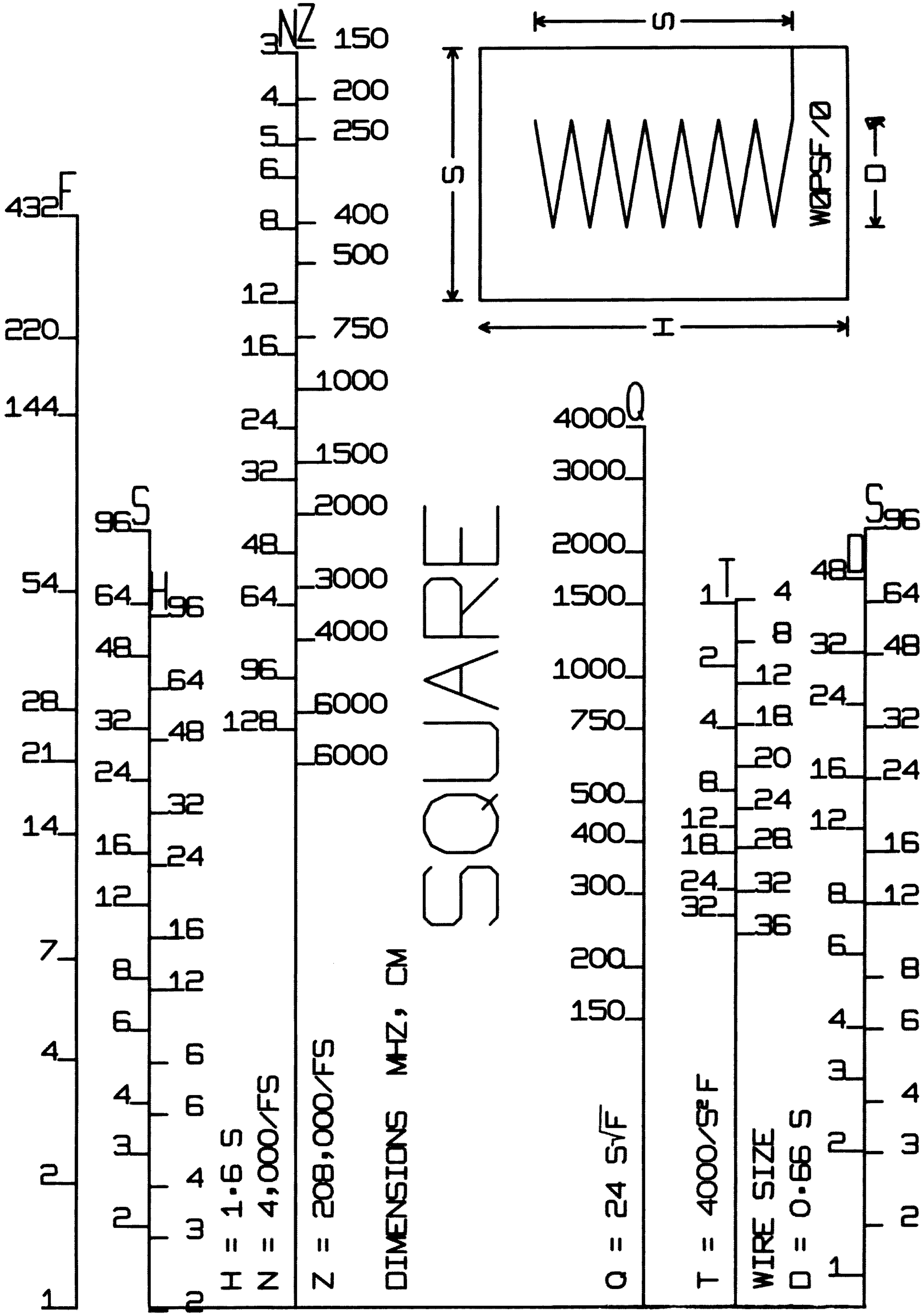

Fig. 2. Nomograph for determining the dimensions of helical resonators in square shields. See text and Fig. 1a, for use.

and H are read from the lower edge. Q, impedance (Z), number of turns (N), turns per centimeter (T), and wire size are read from the top. For the example: 2.2, 5.3, 370, 3000, 14.3, 30. Wire size is that which fills half of the winding space. In this manner, the effect of shield size on the desired parameters may be quickly explored. No attempt has been made to add many divisions to the scales as working values should be calculated from the formulas listed near each line. Values will be within ten percent. Practical size limits are those smaller than results in less than three turns, where the helix loses its shape and larger than that where wire size is limited by number of turns and resistance degrades Q.

Ideally the shield should be seamless. Unplated copper pipe is excellent up to 100 MHz, but wastes space unless amplifier components are fitted in. Square shields are compact, and soldering or dip brazing the seams shouldn't prove difficult for the home constructor.

If, as in the formulas given, the shield extends beyond the coil, no top or bottom caps are needed unless maximum shielding is desired. If used, they must be soldered for low loss. The coil may be directly grounded or attached to a low loss feedthrough capacitor if needed. The open end should not turn in or out and the end rounded if power is to be applied. Any coil form should be of low loss material.

Coupling is best determined by trial. Simplest is the familiar tap, very close to the grounded end, which also adds stability to the coil. A link around the grounded end or a probe at the open end have been used. An aperture at the base is often used to couple square shields, but is difficult to adjust. A variable capacitor in series with the normally grounded end allows variable coupling: minimum coupling being when the capacitance is series resonant with the portion of the coil below the tap and maximum coupling at maximum capacity. Fine tuning may be made by deforming the coil slightly or by adding a small trimmer or disc to the open end.

With their inherent simplicity, helical resonators should find numerous applications as repeater front ends, as narrowband receiver filters for the DX bands, and even W1BB might find the 1 KHz bandwidth of a large oil drum useful on 160m.

...WØPSF/Ø

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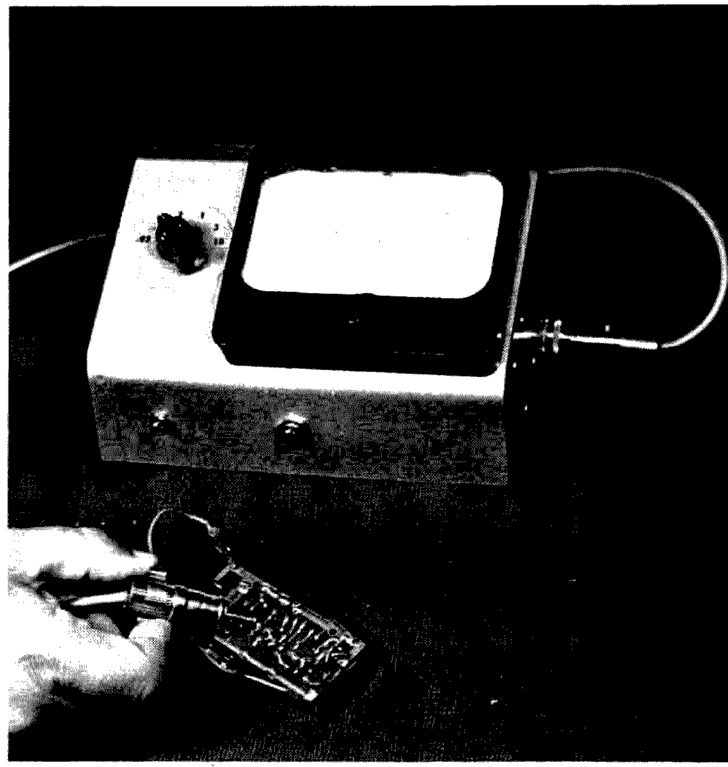


SENSITIVE RF VOLTMETER

This rf voltmeter has full-scale ranges from 0.03V to 10V and frequency response flat from 40 kHz to over 200 MHz, making it useful for most solid-state work. It is portable and battery operated. I had need of such a meter in my work. After hauling a commercial meter and a 115V ac generator out in the boondocks a few times, I decided to try and build a battery-operated meter.

The performance and accuracy of the finished meter depends greatly on how much care is taken with the matching of the semiconductors in it, and the adjustment and calibration. These procedures will therefore be described in considerable detail.

The circuit uses a rectifier-type probe, followed by a high-gain dc amplifier driving a milliammeter. The first try at a dc amplifier used a pair of FET's connected as a differential amplifier to drive a microammeter. To get the required sensitivity, it was necessary to select high-transconductance, high-current FET's and to use a meter of 0–50 μA or even less range. It was found that this circuit required 18–20V supply to keep the FET's operating linearly, and it could dump several milliamperes into the meter if it became unbalanced for any reason. When I found I had no spare sensitive meter, and none of my friends was about to turn any loose, this whole approach was dropped.

A two-stage amplifier was then tried. This time the FET's were chosen for low pinch-off voltage, therefore low current drain. This meant the voltage drop in the biasing resistor and the drop from drain to source could also be low. The stage would work with supply voltage from a 9V battery, even a fairly old battery which had fallen off to 7V or so. The gain of the stage was low, too, but the following high-gain pair of transistors in the second stage took care of that. The complete circuit in Fig. 1 would easily drive a rugged 1-mA meter. At the same time, it would not deliver enough overload current to hurt the meter. The total battery drain was about 5 mA from a 9V battery.

The rf probe is a voltage doubler circuit, using silicon diodes which are forward-biased for maximum sensitivity. Germanium diodes were tried first, but the silicon diodes proved to be much less affected by temperature. With proper forward bias, there is very little difference in small-signal performance between germanium and silicon types. A second pair of diodes with no rf input signal are mounted in the probe and connected to the other side of the dc amplifier's balanced input circuit, thus compensating for any temperature drift in the rectifier diodes. The capacitors C1 and C2 in the probe are deliberately kept small to restrict the low frequency response of the meter for several

reasons: to make the meter insensitive to hum pickup, to make it read carrier level on an audio-modulated signal regardless of the modulation percentage, and to minimize the strain on the diodes if the probe is accidentally touched to a point of high dc potential.

Referring to Fig. 1., diodes CR1, CR2 and capacitors C1, C2 are the voltage doubler. The compensating diodes CR3, CR4 are mounted in the probe also, so they will stay at the same temperature as CR1 and CR2. The diodes are type 1N914, which have excellent high frequency performance, reasonably high voltage rating and low cost. These parts are mounted in an old lipstick case. The business end of the probe is a piece of No. 14 tinned bus wire, straightened out and filed to a point. The removable 50Ω 2W load is built into the lipstick cap as shown in Fig. 2. At the 10V maximum input to the instrument, this load just reaches full dissipation. The reverse voltage rating of the diodes is high enough so there is a comfortable margin of safety at 10V rf input. The probe connects through two-conductor shielded microphone cable to a two pin microphone plug mating with the two pin connector on the cabinet. Any small three-wire or two-wire-plus-ground connector would do.

The Amplified Circuit

The dc signal and reference outputs from the probe are each connected to a voltage divider associated with the range switch S1. The cold ends of the two voltage-divider strings are connected to the bias source, diodes CR5 and CR6, which are supplied about 0.4 mA current through resistor R11. (This is far more current than will ever flow in the voltage dividers, so there is always current flowing through CR5 and CR6.) The negative voltage across CR5 and CR6 forward biases the signal diodes CR1 and CR2 for best sensitivity. Even with no rf input to the probe, a tiny forward current flows from the bias source through resistors R1, 2, 3, 4, 5 and the signal diodes. An equal current flows through R6, 7, 8, 9, 10 and the reference diodes CR3, CR4, so that if the diodes and resistors have been well matched (as described later), equal voltages will appear at the output contacts of switch sections S1a and S1b when no rf signal is applied to the probe, and the meter will read zero. As rf signal is applied, the dc voltage at

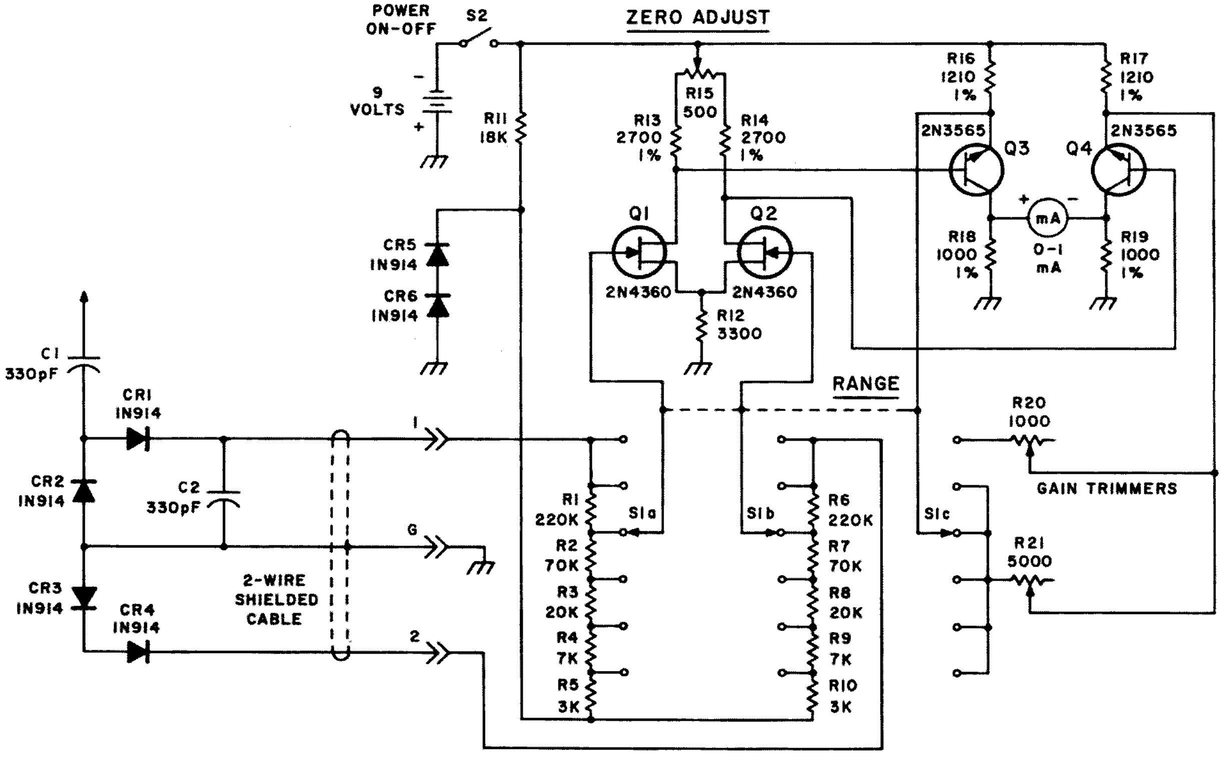
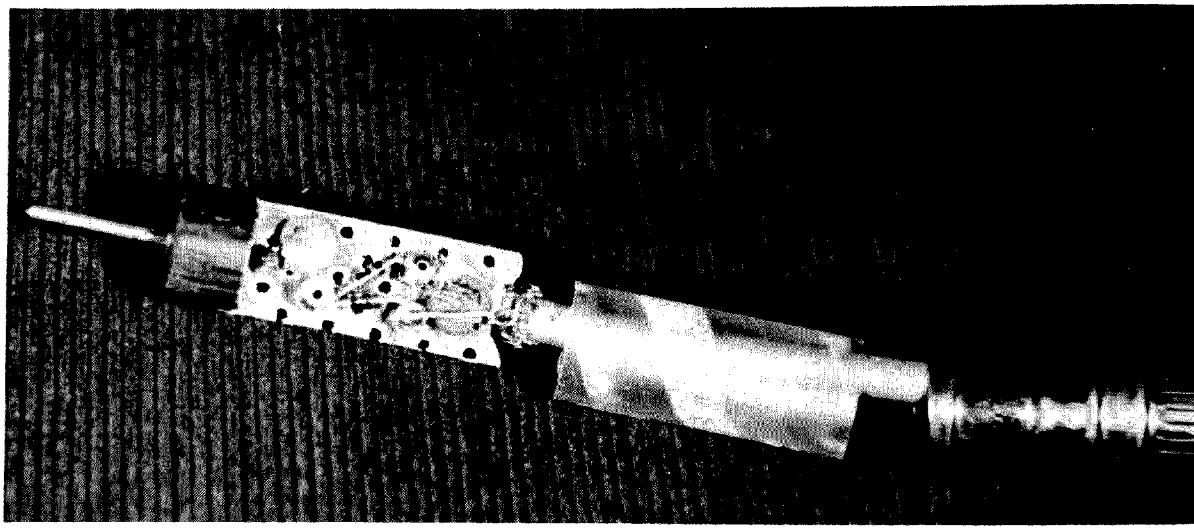


Fig. 1. Circuit diagram of the WA6NIL rf voltmeter.



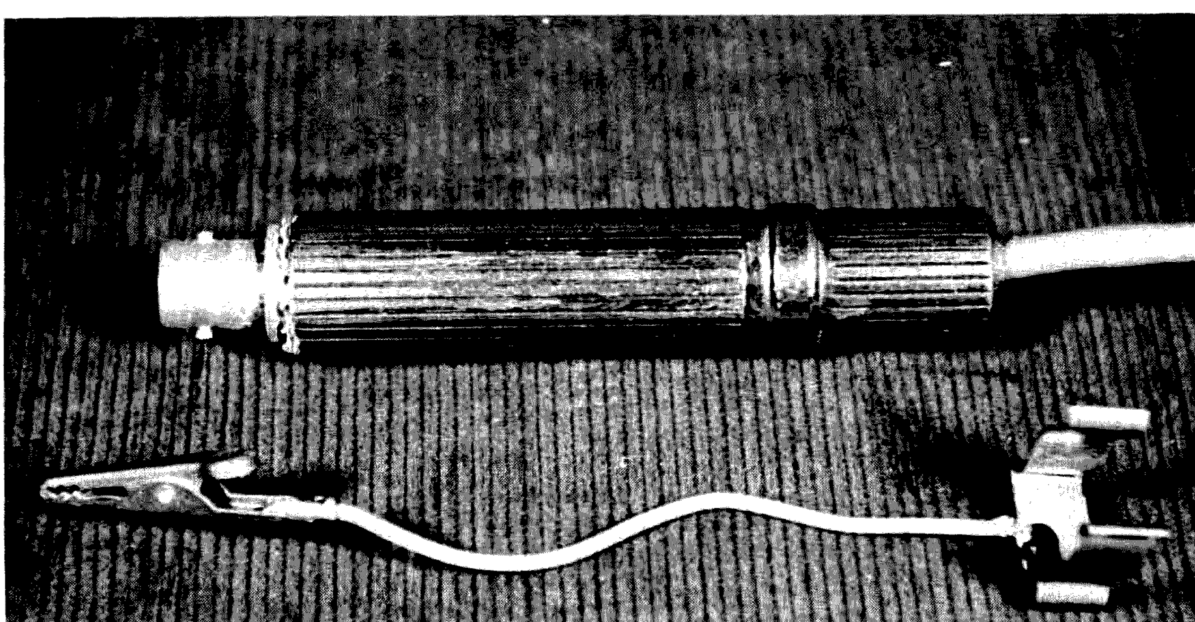
The rf probe is built on a small piece of perf-board and then tucked into your favorite-brand lipstick case.

S1a (feeding the gate of FET amplifier Q1) becomes more positive, while the voltage at S1b feeding the gate of Q2 stays put.

Field-effect transistors Q1 and Q2 are matched and the Zero Adjust control R15 is set so that the drain voltages of Q1 and Q2 are equal when their gate voltages are equal, that is, when no rf input voltage is applied to the probe. The large common-source resistor R12 causes the total drain current of Q1 and Q2 to stay about constant, so that while Q1 drain voltage goes negative as rf signal is applied, Q2 drain voltage goes positive by a nearly equal amount.

The second-stage amplifiers Q3 and Q4 are high-gain NPN transistors, selected for highest gain and matched so that the meter between their collectors reads zero or very near it when the voltages at their bases (from Q1 and Q2 drains) are equal. A slight adjustment of the Zero Adjust control will then make the meter read exactly zero at no signal input.

The large resistors R16, R17 in the emitter circuits of Q3 and Q4 would, without the gain trimmer resistors, make this stage very low gain and stable because of the large inverse feedback. One of the gain



The top of the case contains a 50Ω load and plugs onto the rf probe. The construction is detailed in Fig. 2. Ground connection is accomplished via the short piece of wire and clip.

trimmer variable resistors, R20 or R21, as selected by the range switch S1c, is connected between the two emitters; when this resistance is small, the inverse feedback is cut down and the stage gain is high, while when the gain trimmer resistance is high, the stage gain drops to a low value. It was originally intended that this method of changing gain would be used for switching between the three most sensitive ranges, leaving the other ranges to be switched by the voltage divider R1-R5. However, the efficiency of the diodes in the probe is very low on the 0.03V range, so there is a large difference in gain between this and the 0.1V range in the dc amplifier. The Q3-Q4 stage must run at nearly full gain on the 0.03V

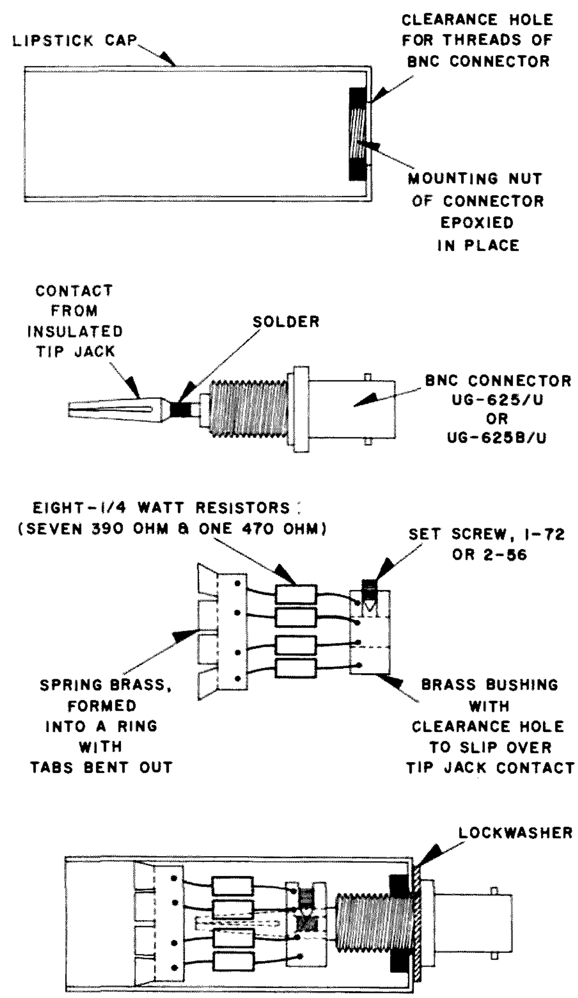


Fig. 2. Construction of the 50Ω probe adaptor.

range, and almost at minimum gain on the 0.1V range. The voltage divider then provides switching to all the higher ranges. A third gain-trimming resistor was originally provided and can be seen in the photo, but will not be needed if the voltage divider resistors are adjusted as described later.

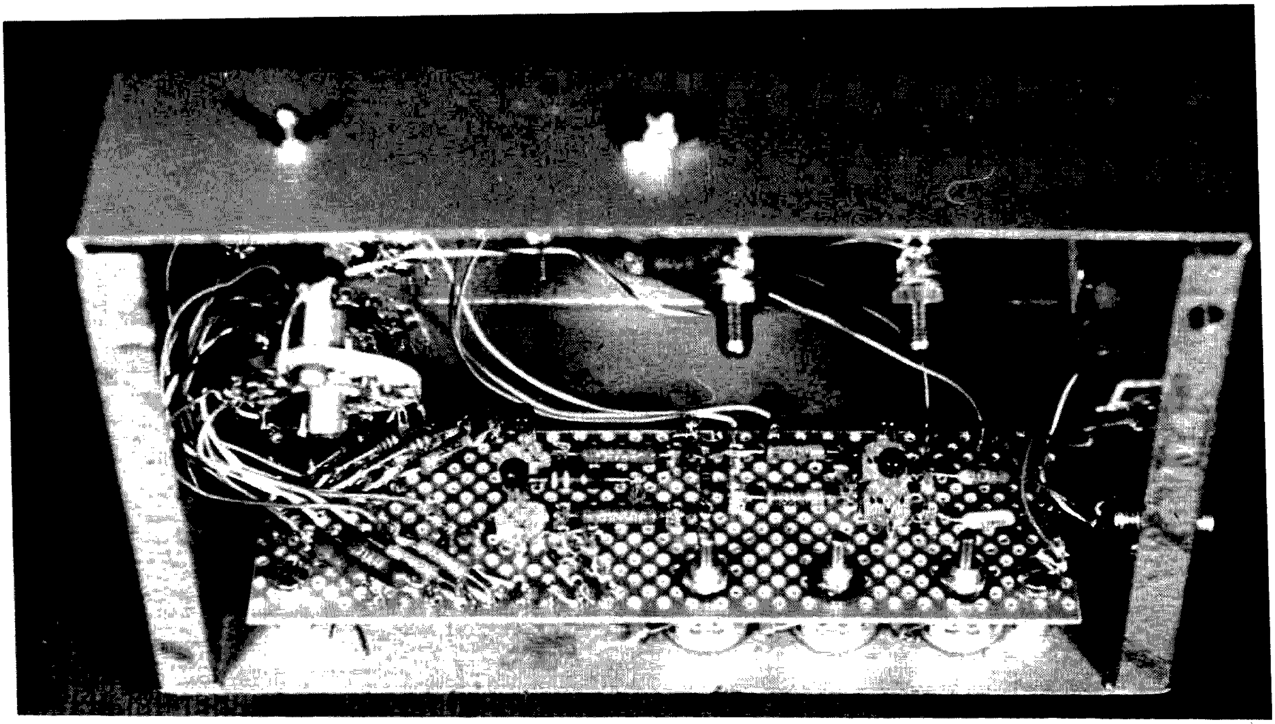
The 1 mA meter is a surplus item. It is a large rectangular type; a large size is desirable since four scales must be put on it. The meter originally had an odd-ball scale, furlongs per fortnight or something, but this did not matter as new scales had to be drawn and hand-calibrated anyway. The original scale was used to determine the proper size and location of the new scales. The dial plate was then turned over and the new scale glued on its back with rubber cement. The meter is connected between Q3 and Q4 collector to read the current unbalance between them.

Construction

The layout and wiring of the instrument is not critical. All the high-frequency circuitry is in the probe, and the rest can be laid out in any convenient fashion. The only front panel controls are the range switch, the battery on-off switch and the zero-adjust potentiometer. I used a screwdriver-adjusted control for the zero adjust, as it was all I had, but a knob would be better. I built my meter in a sloping-front cabinet which happened to be in the junk box, with the dc amplifier and voltage dividers on a piece of perforated board with push-in terminals. This construction is like a breadboard in that it is easy to make circuit changes, yet it is compact, rugged and stable enough for a permanent job.

Looking back on it, mounting the voltage dividers R1-R5 and R6-R10 on the range switch would have made the job a lot simpler, since not so many wires would have run between the switch and the circuit board. The FET's and transistors were mounted in sockets rather than soldered in, to make matching easier.

The first thing to do is to lay out the parts in the cabinet or chassis and panel, and mount the meter, zero adjust control, on-off switch, battery holder and the connector for the rf probe. The range switch with its



Underchassis view of the voltmeter showing component mounting. The gain trimming pots are mounted along the bottom edge.

associated resistors should be mounted temporarily where it will be accessible, as the values of the resistors will have to be adjusted later. Then the circuit board is laid out and built up with the sockets for Q1, 2, 3, 4 and the rest of the parts. Most of the semiconductors in the circuit must be selected and matched, but the bias source diodes CR5 and CR6 are not critical and may be mounted at this time. When installing diodes, it is good insurance to make a small loop in the lead wires between the body of the diode and the solder terminal, to relieve the strain. If you can, use close-tolerance resistors where they are called for. Buying 1 percent resistors in small quantities is an expensive sport unless you can find them in surplus. Matching of pairs of resistors in the two sides of the circuit, such as R13 with R14, or R16 with R17, is more important than their actual value. In the case of the voltage divider resistors, their values will be trimmed later anyway, so the main reason for using precision resistors here is their stability. If you are forced to use ordinary composition resistors, pick matched pairs with a good ohmmeter and use the same precautions you would when soldering in transistors or diodes – leave a little length of lead between the body of the resistor and the solder joint, and put an alligator clip or other heat sink on the lead while soldering.

When this much of the circuit is built up and checked out visually and with the ohmmeter, you are ready to select the FET's and transistors.

Selection of Semiconductors

This circuit does not use any of the fancier techniques such as chopper stabilization to hold down unbalance and drift. It is therefore very necessary to select and match the semiconductors for best results, especially since the inexpensive devices used in this circuit have a much wider spread in characteristics than do vacuum tubes. It is true that carefully matched pairs of FET's can be had, but these could easily cost more than the whole instrument. It seems much better for amateur purposes to buy a good quantity of each type and select out pairs, leaving the rest available for other uses. It is a great help

if you have access to a stock of them. In any case, you should have available at least half a dozen each of the 2N4360's and 2N3565's and a dozen 1N914's or 1N914A's. It won't hurt to have more, as they are all very useful devices.

The first step is to select the FET pair, Q1 and Q2. Set up the test circuit of Fig. 3, remembering that the FET pin connections are different from transistors. Plug in the 2N4360's one after the other and select all those which draw between 0.4 and 0.5 mA. Pick the two which draw most nearly the same current and put them in Q1 and Q2 sockets.

Now to match up the second stage transistors. Switch to the 0.03V range and turn gain trimmer R20 to zero resistance. Connect the circuit to the 9V battery. Temporarily connect the base pins of Q3 and Q4 sockets to each other with a clip lead or jumper. Now try various pairs of 2N3565's in the sockets, looking for pairs that make the meter read nearest zero. If you have a transsistor dc beta (h_{FE}) tester available, pick the pair that show the highest beta. If not, remove the temporary jumper from Q3-Q4 sockets. Plug each selected pair of 2N3565's in turn into Q3 and Q4 sockets, and choose the pair which produce the greatest meter deflection for a given small amount of the zero adjust control. Leave the chosen pair in Q3 and Q4 sockets.

This much of the circuit is a nice sensitive dc voltmeter of about 10 mV dc full scale deflection at maximum gain. It is now ready to be used for matching up the diodes. Set the range switch to its 0.1V range and adjust the gain trimmer R21 to maximum resistance. Connect one diode between input pin 1 of the probe connector and ground as shown in Fig. 4; be sure to connect it the right way round. Temporarily jumper input pin 1 to pin 2 and turn the zero adjust control to put the meter needle on some

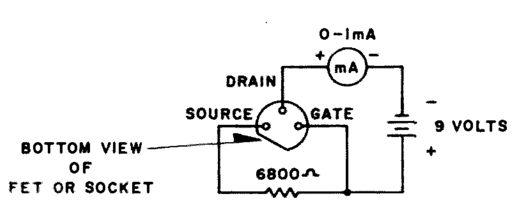


Fig. 3. Test circuit for selecting matched FET's.

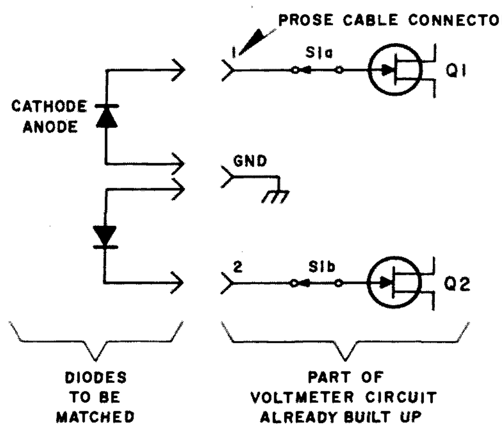


Fig. 4. Method of matching 1N914 diodes.

mark near the center of the scale. Now remove the jumper between the input terminals. Try the other 1N914 diodes between input pin 2 and ground, sorting them into groups by the meter deflection they cause.

Switch to the 0.03V range, set R20 to zero resistance, and again jumper the input pins together. Turn the zero adjust control to put the meter needle on the mark. Remove the jumper, and try pairs of diodes from the various groups for match by connecting one diode from pin 1 to ground and the other from pin 2 to ground. The idea is to pick pairs of diodes which bring the meter needle closest to the mark, thus having exactly the same voltage drop as closely as possible.

Use one of the best-matched pairs of diodes for CR1 and CR3, and another well-matched pair for CR2 and CR4. It is not necessary that CR1 and CR2 be alike, or CR3 and CR4, though it will do no harm. These diodes may now be installed in the rf probe, observing the usual soldering precautions, and the probe assembly finished up.

The meter is now ready to be calibrated.

Range Adjustment and Calibration

Calibration of the voltmeter requires a radio-frequency signal of known and adjustable level. If you can borrow a good signal generator with 2 or 3V rms maximum output, it will do nicely. An uncalibrated signal source can also be used if you have some way of measuring its output, such as a calibrated oscilloscope or another rf voltmeter. If a signal generator is used, be sure to consult its instruction manual to find out

whether it delivers its rated voltage output into a matched load or an open circuit. Most generators built in the U.S. deliver rated voltage into a 50Ω load. Assuming you have such a generator, attach the 50Ω load to the rf probe and connect it to the signal generator output.

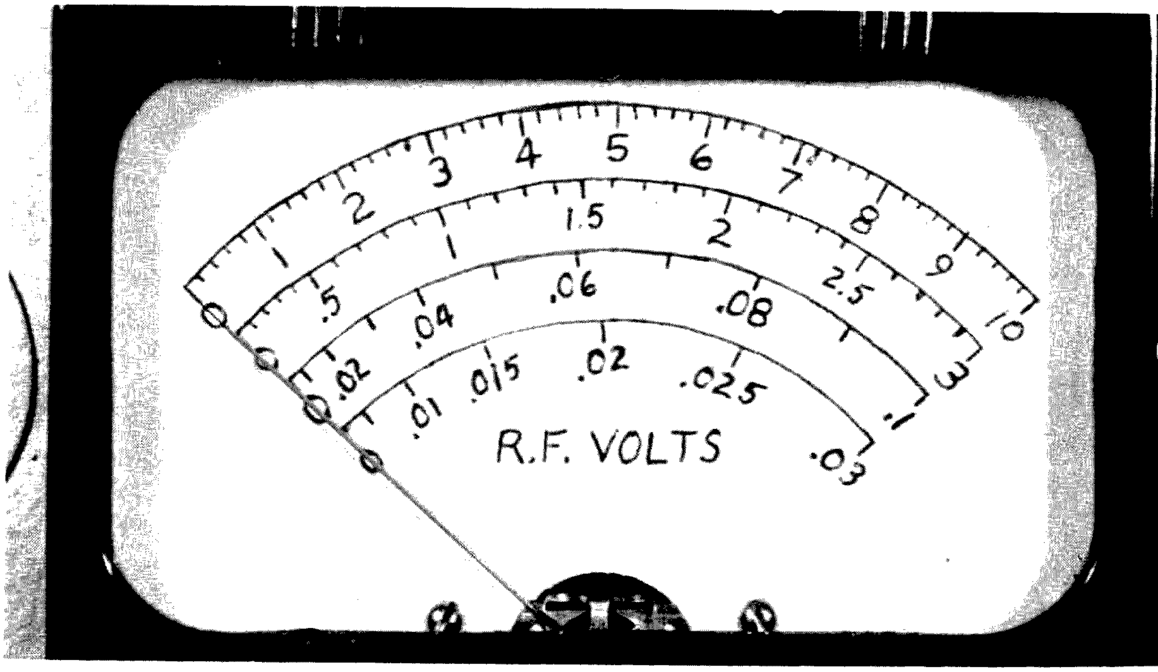
Switch the range switch to 0.03V. With no signal input, turn the zero adjust control to zero the meter. Put in the 0.03V rms signal at a frequency of a few megahertz and adjust gain trimmer R20 for full scale meter deflection. (If full scale deflection cannot be obtained, you will have to pick a higher gain pair of FET's Q1 and Q2, or higher gain transistors Q3 and Q4.) Now switch to the 0.1V range and, with no signal input, again zero the meter. Put 0.1V rms into the probe and adjust trimmer R21 for full scale deflection. On each range, recheck the zero after adjusting the gain trimmer; readjust both the zero and the gain as necessary.

Switch to 0.3V range and re-zero the meter with no input signal. Put in 0.3V rms and note the meter reading. If it is over full scale, R2 is too high. Connect a variable resistor of several megohms maximum resistance across R2 and adjust it for full scale deflection. Remove the variable resistor, check its resistance with an ohmmeter and connect a fixed resistor of this value across R2 with the usual soldering precautions. (If the meter reading was below full scale, R1 is too high and must be shunted down in the same way, but this is not likely.)

Now switch to 1V range, re-zero the meter, and put 1V rms in. The meter will probably read over full scale again, indicating that R3 is too high. Shunt it down in the same way. If the change in R3 is more than 5% or so, go back and check the 0.3V range again.

Switch to the 3V range, re-zero the meter and put 3V rms in. Shunt down R4 to make the meter read full scale.

Switch to the 10V range and re-zero the meter. Put in 10V rms (if available) and shunt down R5 as necessary for full scale reading. If your rf source will not put out this much, you can assume that the meter scale is linear on this range, and adjust to make the meter read at the right point on the scale for the voltage you do have.



Close-up of the recalibrated meter face. Because four separate scales are required, a large meter allows direct calibration without the scales crowding together.

The meter may now be hand calibrated. Starting with the 0.03V range, recheck the zero and full scale readings of the meter as above, then put in levels of 5, 10, 15, etc., up to 30 mV, and write down the deflection on the original meter scale for each input voltage. Calibrate each higher range in the same way, using appropriate steps of input voltage. The meter scale may be drawn up by any of the usual methods, such as making an enlarged layout and photographing it. I drew mine up actual size, with a ball point pen on white card stock, and fastened it on the back side of the original scale with rubber cement. The finished scale is shown in the photograph. Since the scales get very non-linear at small voltages, separate scales are required for the 0.03V and 0.1V ranges. One scale can be made to do for the 0.3 and 3V ranges, by compromising a little, and one scale for the 1 and 10V ranges.

As an added refinement, you can tinker with the circuit to reduce the shift in meter zero when changing ranges. If there is much shift when switching between 0.3V and 0.1V ranges, try interchanging transistors Q3 and Q4. If the shift reverses when this is done, a better matched pair of transistors is needed. If it stays the same, a tiny adjustment of resistors R16 and R17 for better match is needed.

If the zero shifts when going to higher ranges, adjust the resistors R7 through R10 as necessary. The zero shift should be very small if they are made equal to the corresponding resistors R2 through R5.

The range switch may now be installed in its permanent location and the assembly of the instrument completed.

Use of Other Types of Semiconductors

The diodes in the probe should be silicon high speed types. As mentioned, the 1N914 is quite satisfactory. It is made by several manufacturers and is quite inexpensive, and there seems to be little reason to use anything else. If you have some others on hand you want to try, they should have something like the 4 nanosecond recovery time of the 1N914. For the 10V maximum range of this meter, a peak inverse rating of 40 or 50V would do; the 100V of the 1N914 gives a desirable safety margin. The bias diodes CR5 and CR6 should be the same type used in the probe.

The 2N4360 FET is a P-channel junction type. It is made by Fairchild and may not be as widely available as those of some other manufacturers. Other P-channel units may

be used; the main thing is to get or select some that have a fairly low pinch-off voltage, so that they will work at low enough supply voltage in the given circuit. N-channel types could be used also, but this would mean that the following transistors Q3 and Q4 would have to be changed from NPN to PNP types, and the polarity of all the diodes, the meter and the battery would have to be reversed.

The 2N3565 is a very high gain type; the ones in my meter have a h_{FE} (beta) of 275. This again is a Fairchild device. Other NPN transistors which look suitable are the 2N3117, 2N3692, 2N3711, 2N4124 and the 2N5131. A browse through the manufacturers' catalogs will turn up others. If you should change the circuit to use PNP types as mentioned above, the 2N3965, 2N4062, 2N4126 and 2N4250 are some of the possibilities. You could get by with less beta by using a more sensitive meter than 1 mA, or by doing without the 0.03V range; this would allow many more silicon types to be used. (Dropping that lowest range would simplify the circuit considerably as well.)

Conclusion

The frequency response of the completed meter was measured to be 1 dB down on the low end at 40 kHz. At the upper end, it was still flat at 216 MHz, the upper limit of the available signal generator. The input impedance of the probe was measured with an R-X meter; it proved to be 4 pF shunted by a resistance of 30,000Ω at 1 MHz. At higher frequencies, the capacitance remained 4 pF, but the shunt resistance dropped gradually, being 8,000Ω at 30 MHz and 1000Ω at 200 MHz.

With the 50Ω load attached to the probe, the meter will indicate rf power from a few microwatts up to 2W maxmimum. (Power equals E^2/R.) Without the 50Ω load, the probe may be used directly on sensitive circuitry, provided its 4 pF capacitance can be allowed for. Thus the meter will be found very handy for working on nearly all solid-state and other low power circuits.

Many thanks to Dave Annett WB6DBE for taking the photographs, and to Lloyd Provan for enlarging them.

...WA6NIL

Bob Manning K1YSD
Rye, NH

the "GREENIE"

The Wayne Green Award, or *Greenie*, came into existence in much the same way as did penicillin, the St. Andreas Fault and *me* – by sheer accident!

Recently, an obscure and nameless ham with the solder-wasting, foot-scarring and improbable talent of constructing breadboards with a propane torch, discovered his solder had been dropping into a scrunched-up, cast-off TV dinner plate secreted under his bench.

When – after several pounds had accumulated – the mass was removed and turned upright, it bore not only an amazing resemblance to Wayne Green (dutch boy haircut, turtleneck sweater and all), but two embossed letters, *E* and *L*, from the plate had been reverse fashioned into the glop somehow, making a passable *73*. Thus the *Greenie* was born!

Its destiny was to be awarded to the ham with the best – or most unusual – shack.

We (the awards committee), after visiting hundreds of shacks, were gathered in the huge 8 x 10 ft conference room to decide who should receive the coveted first annual Wayne Green Shack of the Year Award (no double entendre intended!).

To say it was an odd assemblage would be putting it mildly. It was, however, fairly representative. Wayne, himself, was in absentia – having gone off to fight simultaneous duels with the editors of *CQ* and *QST* (FCC Proposals at 300 meters).

Katrina of course was there, representing the YLs. Slightly over 300 pounds of Fem-Lib amateur radio operator, Katrina was – to say the least – imposing. A feminist to the last ounce, Katrina, at the moment, was banging alternately on the simulated alabster (plywood) table (Wayne spares no expense) and thumping Claude Zister, our technical type, on his emaciated chest, causing him to retch violently at each thump.

Claude isn't a bad sort, despite the fact that he and the slide rule he kept clutched in his bony fist were of unusually similar stature and weight. Only guy I ever knew who made Wally Cox and Twiggy look like Minnesota Fats and Mama Cass Elliot!

"It's gotta be a YL or XYL to win the award!" bellowed Katrina. "You male chauvinists have had it too much your own way for too long."

"Balls!" roared Grunt (at least I think his name was Grunt. He rarely spoke below 721 dB over S-9 which, when we first met, numbed my eardrums and I never was sure of what he'd said when he'd introduced himself).

During our inspection tour he yelled into one guy's mike so loudly and so excitedly that he bit the top right off a Shure 444. Grunt was the representative of that new breed of operation, The SuperHam! You've undoubtedly met them on the bands.

The SuperHam comes through, on the air, as a fiftyish, loudmouthed, know-it-all clot dedicated to the proposition that only *he* is created equal. He claims squatters rights to *his* frequency, and by virtue of thirty-two series paralleled 4-1000Z's simply opens up

and takes over at least 20 kHz of band width. Faster than a millisecond VOX, more powerful than the law allows, able to stomp QRP stations with a single belch. Ooh hoo! Look! There on the air! it's Aurora! It's insane! It's SOOOOPPERHAAAAMM!!!

"And again I say Balls!" roared Grunt. "It's gotta be a station with power, power, P.O.W.E.R. power and more power!"

At this point our secretary, Maggie (the message handler) began rummaging through an oversized Samsonite suitcase, the outside of which boasted – instead of travel decals – stick-on message check-off sheets, HX and ARL numbered references. "Wait a minute. I've got some notes here," she said, scattering message forms and blanks over her shoulder, the table and the floor.

"Yeah! Hold it!" chimed in Cecil, the certificate hunter, performing a similar act save for the fact that he was strewing certificates hither and yon. (Funny, I never did get used to Cecil's attire; the single breasted oversized WAS certificate for a jacket made from seersucker was bad. The bell bottoms fashioned from quilted CHC memorabilia was worse, but the tie that glowed in the dark showing his DXCC made me feel like someone was stepping on my throat.)

From the corner, Effram – our CW operator – was bleating, "Didah dididit, didah dididit."

Looking up from my navel (which, incidentally, in the last five years has gone from the outward type to the inward type), I began to pound my gavel for order. I, as the appliance operator-klutz-lid representative, was the chairman of this motley group.

"Order, order!" I screamed at the room, which had taken on the appearance of a ticker tape parade due to the fact that Maggie and Cecil were still flinging papers into the air. Katrina was hollering 'YL, YL, YL!". Grunt was bellowing, "Balls! Power-power-power I tell ya – ya gotta have power!" and Effram was driving me slightly off my rocker with that "didah dididit, didah didit!" It sounded like a Chinese auctioneer with a cleft palate conducting a sing-along for 200 babbling tambourine thumping chimpanzees.

Bang, bang, bang went the gavel as I pounded at the chaos. Suddenly I felt several sharp pains just below my spleen and discovered Claude poking me with his slide rule. "Excuse me, sir," he said, "but I believe you've just spilled your coffee into your lap."

"Thank God!" I exclaimed, "I thought it was something else."

Some semblance of order finally arrived except for Effram with his "didah dididit" and "dahdahdidah dah dahdidahdit."

"Grunt," I said, "will you put Effram on break-in and tell him to QRT."

"Huh? Whazzat, boy? You gotta speak up, boy! You need more power. More power, I say. Power, boy, slap the ole juice to it till the tubes run rosy red and the transformer fires – power, boy, power!"

Thankfully, Katrina took a hand and solved the problem with delicate feminine expertise. Clamping onto Effram's hand containing a soup spoon with which he was tappy-tappy-tapping something, she jammed both spoon and hand down his throat, coming dangerously close to his liver. Then, in what seemed to be a single motion, she grabbed Maggie's oversized attache case, and with a vicious arced swing whomped Grunt approximately 32 inches above his ankles – or – at the apex of his V, as we say in the trade.

"Okay," I continued, "now we only got this one trophy to give away. We've seen all sorts of shacks. Suppose we use the process of elimination? I think we can eliminate all the Danish Modern, Colonial and home-antiqued types, right? Any other eliminations? Raise your hands."

A sharp shooting pain under my left eye told me that Claude had raised his hand – replete with slide rule – damn near turning me into a cyclops.

"I think," said Claude, "that we can also eliminte the Japanese Contemporary shack. I mean, after all, 'Ladio Shack?' 'Landom Rength of LG/8U' and 'Loger, Loger OM' is a bit much; besides, the autographed 8 X 10 glossies of Sessue Hayakawa and Richard Loo in bamboo frames? Pfuii!. And how many operators will deliberately live on the side of a hill so they can erect slanted inverted vee's?"

"And it didn't got no power neither. No balls at all." chimed in a slightly falsetto Grunt, assuming a cross-legged protective pose as he cast a suspicious eye at Katrina.

"Yeah, and it was all commercial. He didn't have no home brew stuff anywhere!" came a voice from under the table.

"Who the hell is *that*?" I gasped, as a pair of hands and two eyes peered over the tabletop.

"Tis I, Marvin, the home brew specialist."

"Whatinhell are ya doin' under the table, Marvin, the home brew specialist?"

"I'm building a voting machine," Marvin replied, piling soldering gun, heat sinks, dikes and assorted other tools on top of a stack of Maggie's messages and Cecil's certificates.

"Look, old boy, I think I soldered my belt buckle to a table hinge, so I'll just sit here, okay?"

"Fer cripes sakes. Is that everybody?" I said – glancing around the room and under the table – absently noting that Marvin had, indeed, soldered his belt buckle to the table hinge.

"I believe," said Claude, manipulating his slide rule back and forth and making copious notes on a seemingly endless sheet of foolscap, "that we're missing one-point-three persons."

"Whaddya mean, 'one *point* three persons'?"

"Well, Baltimore-Anchorage-Roanoke-Rochester-Yokahama – what a name – the 20 meter, quick QSO kook was captured by an A&P manager and is working the 'five items or less' checkout counter around the corner. He was 'Hi there! You're 5 and 9 – that's a dollar 9.80 see you latering' to beat the band the last time I saw him."

"Okay," I said, "That's one – now what's the point three?

"Oh, that's Giggles. You can't really call him a full ham. I don't know what category he falls into. He's the fruitcake who checks into a net and spends the next 45 minutes tripping his VOX with giggles."

"I know the type. Thanks, Claude."

"Think nothing of it," said Claude, making a magnanimous arm-sweeping gesture, catching me across the bridge of the nose with that goddam ruler.

"I think you just deviated my septum, you . . . . . . "

"Didididit didit" "Didididit didit" came from the end of the table.

"Claude, why don't you go down and teach semaphore to Effram and take that mathematical pogo stick with you." I said, wiping a tear from my eye and a spot of blood from my nases.

"Okay, any more eliminations"

Katrina jumped to her feet (this act by its sheer spontaniety caused Grunt to explode backward against the wall – not an easy feat when you're in a 'September Morn' pose). ' I think" said Katrina, casting a threatening look at the folded-up Grunt, "that we ought to eliminate that Swedish Convertible shack also. Really! A Myra Breckenridge receiver and a Chrstine Jorgensen transmitter. That's carrying synthesis too far. No knobs, no meters no dials, no nuthin', just *one big switch* – or is that *swish*?"

"And it didn't got no power at all. Ya gotta have oomph, guts, punch. Ya gotta have balls!" said Grunt.

"And that thing just can't be made – no pun intended – it can't be made." said Marvin, absently rapping an rf coil around his athletic finger (the one that can make a broad jump!).

"I agree," said Claude, "the absence of a ball bearing drive mechanism on the vfo renders it virtually useless, and I think Effram will agree that a 'marshmallow key' for limp wrists is impractical. Right, Effram?"

"Didahdit didahdit" said Effram.

Just then a "giggle giggle" came from the intercom.

"Giggles, will you get the hell outta the waiting room, quit giggling into that intercom, and join us?"

"Right, Bob – giggle-giggle – but ya know I sort of liked that 'Liberal' shack we saw. You know the one – entire place bedecked hippie style with flowers, beads and black lights using a Lysergic 25 receiver, a MaryJane transmitter and a Horse Amplifier – hey, and the wattmeter labeled 'Flower Power' really IN the log books called a 'trip sheet' and all those petitions. Like the one petitioning all magazines to include a supplement to their "Who's Who"

columns entitled "Who Dat?"'and that jazzy antenna – wow – erected in the form of a 65 foot peace symbol. That's today, Bob!"

"Oh, Lord!", I said.

"Charlie, Charlie" said Maggie.

"According to my calculations, the damned thing WON'T WORK, Giggles!" said Claude.

"Precisely! It's IN" said Giggles.

"Balls!" said Grunt.

"Do I record all this talk as one message or can I count each quote as a separate message?" asked Maggie.

"Hey, yeah! And do I get a certificate for attending this thing?" queried Cecil.

"Look, you band of three toed sloths, we're here to hand out this – this – this – ah – trophy. Now with the Emmys, Oscars, Grammys and all the other awards handed out, it's pretty hard to go through a lifetime without receiving an ward!"

"You're right, Bob. I know a guy who got an award for never having received an award!"

"Look, Marvin," I said. "If you can unsolder your belt buckle without doing yourself any permanent genetic injury, will you get up above the edge of the table, and we'll get this thing settled."

"Now," I began, "as I see it, in order to please everyone, we've got to give it to a YL running in excess of 10 KW on CW for quickie QSO's on 20 meters who receives an occasional BPL, has a good standing in the CHC and has built her entire shack in Early Halloween or Contemporary Junkyard all by herself and can giggle her VOX on phone, right?"

"Listen, BOY, are you out of your cotton-pickin' fumble-fingered Donald Duck-squawking mind?" said Grunt. "There ain't no such animal!"

"WHOOMPP!!!" Katrina struck again, knocking Grunt sidewise into Effram, into Claude, into Giggles and on top of Marvin.

From the resulting jumbled mass, horrible screams emerged and Grunt made a spectacular 7 foot leap into the air.

"Giggle, giggle," said Giggles.

"What now?" I said to a breathless, open-mouthed Katrina.

"Fer crissakes, Katrina," said a near hysterical Marvin. "What'd ya go and do that for? Now I got my belt buckle soldered to Effram's spoon and Claude's slide rule, I think I branded Grunt with a Texas B bar S and Effram is about to choke!" As if to emphasize this point, we could hear a tap tap tap thump thump thump tap tap tap as Effram rapped out an SOS on the table.

"Giggle, giggle."

"Oh Lord!"

We waded into a knotted mass of humanity. Calling on my old Boy Scout training we untangled everything but the spoon and slide rule which we left dangling from Marvin's belt buckle.

"Hey, you damned fools!" hollered Grunt from his position astride the water cooler. "We can forget the whole thing now. That dummy's soldering iron just melted the statue. Ain't no more Greenie. Ain't no award this year, unless you're planning on giving 'em a melted lead tea cozy or one helluva heavy frisbee!"

"Oh, Lord," I said. "Well, Wayne's always saying get the lead out. "

"Giggle, giggle."

"Maybe we could build a parabolic dish out of it," said Marvin.

"Put a number on it so I can log it." said Maggie.

"Hell, let's stamp BPL on it and GIVE it to Maggie " said Katrina.

"Can I keep it as a certificate " asked Cecil.

With extreme calm, I walked to the window and threw the melted glob, my gavel, the buckle-spoon-ruler combination and two handfuls of messages and certificates into the street. Then, as an afterthought, I picked up the still "didididit didit – didididi didit"ing Effram and flung him after his spoon, receiving the ultimated satisfaction of hearing him speak his first real word "HHEELLLLLLLPP!!!"

"Oh, Lord!"

"Giggle, giggle."

"Balls!" said Grunt, Katrina, Maggie, Marvin, Cecil, Giggles and I in unison. And, from the sidewalk, we heard "didahdit" thus putting an epitaph to the Greenie.

. . .K1YSD

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RAPID RECEIVER CONTROL SWITCHING

A simple circuit that provides "touch" switching of various receiver functions for more rapid and easier DX-hunting.

Amateurs who are really interested in improving their receiving setup for DX-hunting or other purposes, usually end up with a receiver containing many modifications. These modifications, such as selectivity and preamplifier devices, may either be internally mounted in the receiver or contained in outboard enclosures. All the modifications may well prove their value in improving receiver performance, but one problem which usually develops is the control of the controls for the accessory circuits. The phrase "control of the controls" may sound a bit strange, but one of the greatest problems in DX-hunting with a receiver is to be able to concentrate on the tuning itself and not be distracted by having to look away to see the setting of other controls or, in fact, to operate other controls.

The simple circuit described in this article allows one to activate by touch control *any* receiver function which is *switch*-operated. The touch plates for different functions can be grouped around the receiver's main tuning knob, as shown in Fig. 1, so that one need not remove one's hand from the tuning knob in order to reach any touch plate. The choice of functions which one may wish to control in this manner is a matter of individual choice, but usually it will be such functions as i-f bandwidth, audio selectivity, sideband selection, etc. Placing a finger on a touch plate will activate the function for which that touch circuit is wired for a time period of 5–10 seconds, then the circuit function will automatically revert to its original state. This method of operation was chosen so that manual override of the touch circuit would be possible at any time by using the regular control switch for a receiver function. Also, the time period chosen

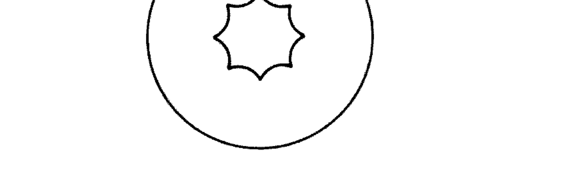

Fig. 1. Possible touch plate arrangement on the front panel of a receiver around the main tuning knob.

allows sufficient time to operate the regular control switch if it is desired to retain the function that was activated and yet the time period is short enough so that, if the circuit function chosen proves not to be useful, it will drop out before too much reception is lost or distorted.

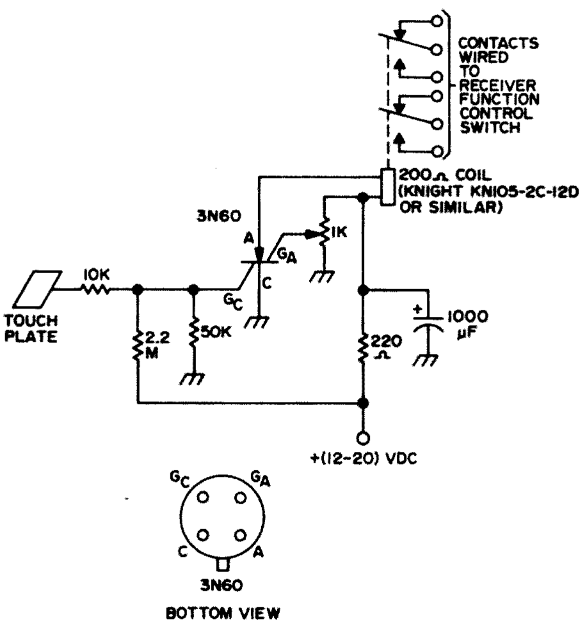

Fig. 2. Schematic of touch-control switching unit utilizing 3N60 or similar SCR. 1K potentiometer controls sensitivity.

Circuit

Figure 2 shows the simple circuit of the touch control unit. It consists of a basic SCR switching circuit utilizing a 3N60, or any similar SCR. Placing one's finger on the touch plate will provide enough pickup voltage at the cathode gate of the SCR so that the SCR will fire and the relay coil will be energized. Any relay can be used which has a 100–200Ω coil and does not require more than about 100 mA operating current. A 1 KΩ potentiometer placed between the anode gate and the power supply side of the relay coil can be used to regulate the sensitivity of the touch plate. Normally, the SCR when fired would continue to conduct indefinitely, unless a switch were provided to "unlatch" the SCR. To provide a means for the SCR to automatically stop conducting after a definite time period, power to the SCR is supplied via an RC network consisting of a 220Ω resistor and 1,000 µF capacitor. Once the SCR has fired it will continue to conduct until the charge on the capacitor decreases to the point where enough current does not flow through the SCR to allow it to remain in a conducting state. When this point is reached, the SCR will stop conducting. Depending upon the characteristics of the relay used, the relay will be de-energized shortly before or at the time the SCR stops conducting. Once the SCR stops conducting, the 1,000 µF capacitor will again charge via the 200Ω resistor. The value of the components for the RC network can be chosen as desired for the time delay desired.

Construction

It is suggested that the circuit first be "breadboarded" so one can determine the proper components to use for the RC network for the time delay desired. The value of the components will vary depending upon the relay used and the supply voltage. The final unit can be assembled on a piece of perforated board stock and mounted in any convenient location in the receiver. The supply voltage need not come from a well-filtered source and can be taken from any available source in the receiver. If necessary, a simple half-way rectifier circuit from the filament line can be used.

The most difficult aspect of the construction of the unit will probably involve that for the touch plate itself, since it involves the question of to what degree one is willing to modify the front panel of a receiver. The area of the touch plate need be no larger than that of a penny, or dime coin. Probably the best way to try the circuit for its usefulness, in fact, is to use something like a

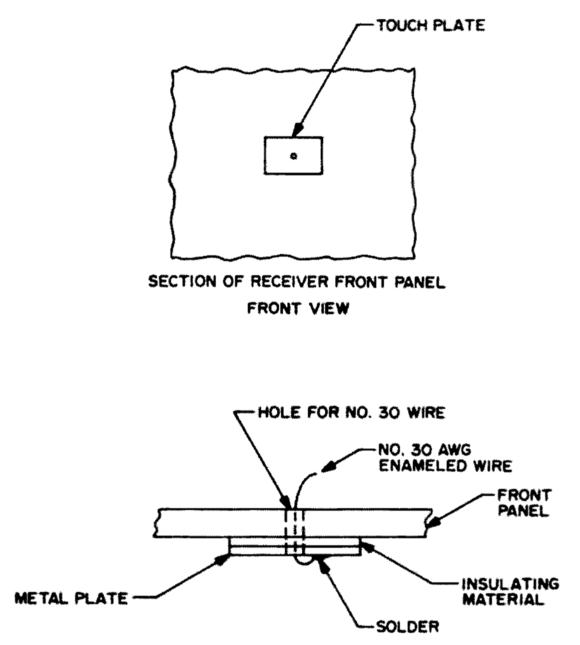

Fig. 3. Details of construction of a touch plate which can be mounted on a receiver front panel.

penny coin with a wire soldered to it as the touch plate. The coin can be placed on the receiver front panel near the tuning knob by means of double-adhesive backed tape and the wire from the coin run under or above the front panel. A more permanent and far neater installation can be made for the touch plate, as shown in Fig. 3. Any piece of metal sheet about the area size of a penny (not necessarily a round shape) is glued to the receiver front panel with an insulated backing of tape or other material. An extremely small hole is then drilled through the metal plate and the front panel just large enough to pass size #30 or smaller enameled magnet wire. The end of the wire is touch-soldered to the metal plate. In this way, if the metal plate is removed later, the very small drilled hole can easily be covered with touch-up paint, or other material.

The wiring of the relay contacts depends upon the control switch wiring in a given receiver. In most cases where simple on–off type control functions are involved, the relay contacts can simply be wired in parallel with the toggle switch contacts. In more complicated situations, as for instance when a multiple position rotary switch is used to set the receiver selectivity, the relay contacts must be wired across those positions of the switch for the two selectivity positions it is desired to alternate between using the touch switching. A study of the schematic for a specific receiver will reveal many useful ways in which the relay contacts can be wired into various control switches.

Summary

Touch switching of the most frequently used switch-type receiver controls can add a great deal of convenience to receiver tuning, especially under circumstances such as DX-hunting and contest work, where rapid control of various receiver functions is desired. Although touch switching is probably not the ultimate answer, it is at least a step in the direction of solving one of the major design faults with most receivers. That design fault, of course, is the grouping and nature of the controls for receiver functions not being really operator-engineered for rapid utilization.

. . .W2EEY

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INCREASE YOUR SSB EFFICIENCY

add talk power to your signal.

The QRP people, like me, have two ends to improve their efficiency. One is the antenna, the other is the signal to be transmitted. Using SSB in the first place makes the station highly efficient. A good antenna system brings more gain than doubling or tripling the PA power.

How about the intelligence – the speech? Its average modulating performance is as bad as using a kilowatt with a poor antenna. To improve this, we first have to remove the "spikes," causing a low average modulation level or worse – overmodulation (trouble – TVI, RFI and other "I's"). Second, we have to compensate somehow for our inability to keep the volume at a steady level.

After a feasibility study, I ended up with the following solution (I had better say "we," because Hank Giunta and Jerry Stuart were a major support with positive criticism, and enthusiastic advice. I hereby thank both of them).

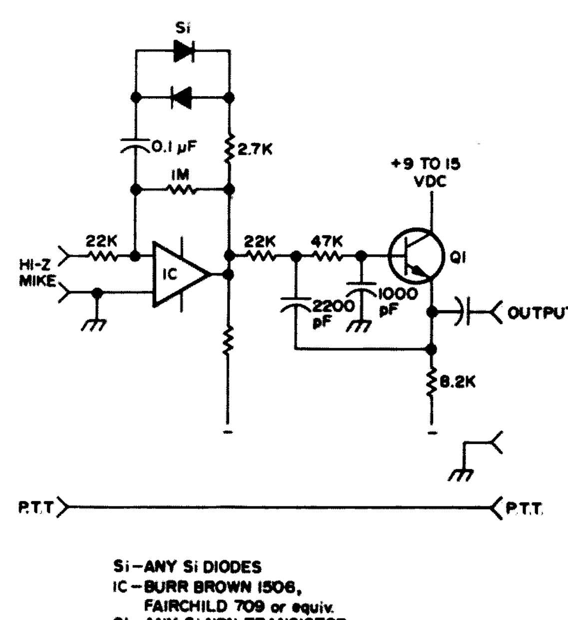

Fig. 1. Schematic. Si: any Si diodes; IC: Burr Brown 1506 or Fairchild 709 or equivalent; X_1: any Si NPN transistor; PS: + and – 9–15V dc.

Table 1. Technical Data

Input mV	Output mV	Gain	Frequency Response:
5	130	26	100 mV input:
10	260	26	0 – 2 kHz 100%
20	460	23	2.7 kHz 87.5%
30	520	17	3.2 kHz 75%
60	600	10	4.4 kHz 50% of gain
150½	700	4.7	
300	800	2.7	
500	850	1.7	

This unit is in use as an "in-line" microphone amplifier and has given me a 10 to 20 dB "gain" from the receiving station for my HW-100 transceiver.

. . .WA6QJU

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IDENTIFY THOSE UNMARKED ICs

You can't pick up a ham magazine or handbook nowadays without finding numerous articles on various pieces of ham gear utilizing integrated circuits. The trend is inevitable. ICs are inexpensive, require less building time and can pack numerous circuitry into no space at all. They are practically indispensable for building keyers, calibrators, converters, counters, amplifiers and signal generators.

There are basically two types of ICs on the market today, digital and linear ICs. Digital ICs, as the name implies operate on a digital system; i.e., ON or OFF like a common switch. This article will deal mainly with the digital IC as it is more prevalent on today's market and adapts readily to testing. A theoretical description of ICs is beyond the scope of this article but can be found in past articles. (For example, "Digital Logic Devices," N. Pos WA6KGP, *QST* July 1968.) Also, Motorola, RCA and International Rectifier IC manuals give easily understandable theory.

Since digital ICs are basically switches, they can be tested as such to determine their condition. Testing ICs prior to "plugging them in" can be well worth while as one bad IC can damage others in the circuitry. Digital ICs are usually used in groups of three or more in many circuits so that each should be proved satisfactory before hooking them all together and throwing the switch.

Linear ICs on the other hand are analog devices. A linear IC chip is made up to provide internal biasing and steering diode circuits. These devices are readily used as AF-IF-RF amplifiers, discriminators, voltage regulators and balanced modulators with a minimum number of external components required. Testing a linear IC therefore requires much more elaborate test gear to check it out just as complete checkout of a tube or transistor requires gain, leakage, frequency response, distortion and other such tests.

Fortunately most linear IC circuits utilize only one IC or at least the IC circuits can be isolated from each other. Therefore, linear ICs can be checked by insertion in the actual circuit with input and output parameters measured without chance of ruining another IC in the circuit.

While testing linear ICs is not covered in this article, the identification feature of this article works just as well for either type.

Both types of ICs are readily available to anyone who has access to surplus flyers, electronic house catalogs or ham magazines. Outfits like TAB, Polypaks, Radio Shack and Meshna sell ICs one at a time to your requirements or in baskets of a dozen or more mixed ICs for the price of a six pack.

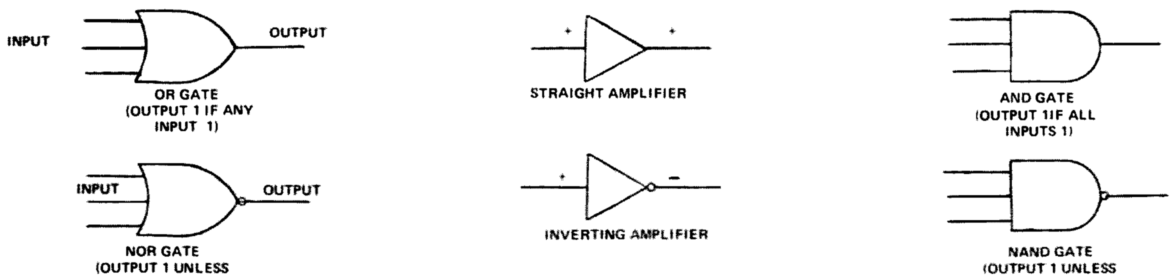


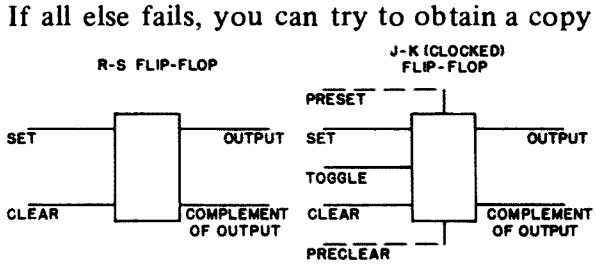
Fig. 1. IC Symbols.

This latter method is the obvious way to get started in ICs.

Identification

The first thing you have to do when you get your bag of bargain ICs is to figure out what they are. (Ever try to use a tube with no number on it?) Sometimes this may be easy if the IC comes with some descriptive literature telling what it is, its pin connections and ratings. More often than not, though, you ll just get the IC and it may or may not have some letters, numbers or both on it along with maybe the manufacturer's name or trademark. If you get any with no markings at all, deep six them as they aren't worth the effort. With the number and manufacturer pinned down, merely drop a card to the manufacturer and most will be glad to send you a description of the device.

If only letters and numbers appear on the device, you're in for slightly more work. Check the prefixes listed on Table 1 and see if you can match your device number with one on the chart. (You'll note some prefixes are used by more than one manufacturer so check entire list.) If this works, again write manufacturer. If not, check some IC replacement guides like Motorola's HEP, RCA's SK series or International Rectifier's IC guide to see if you can uncover the rascal's identity. If all else fails, you can try to obtain a copy of the latest Electronic Design News Semiconductor Annual which seems to list them all. Again remember what you paid for these devices and decide how much effort they're worth.



IF THE SET INPUT IS	AND THE CLEAR INPUT IS	THE OUTPUT WILL
⏚	⏚	NOT CHANGE STATE
⏚	+	GO TO THE ⏚ STATE
+	⏚	GO TO THE + STATE
+	+	GO TO THE ⏚ STATE

IF THE SET INPUT IS	AND THE CLEAR INPUT IS	AND THE TOGGLE IS	THE OUTPUT WILL
⏚	⏚	+ ⏚	CHANGE TO THE OTHER STATE
⏚	+	+ ⏚	GO TO THE ⏚ STATE
+	⏚	+ ⏚	GO TO THE + STATE
+	+	+ ⏚	NOT CHANGE STATE

Fig. 2. IC flip-flop symbols.

Testing

Now, assuming you've found out what it is and its pin connections, you're ready to check it out. For all types, first set up selector switches for Vcc and ground connections. (The two voltage ON-OFF switches should be left off until the setup is confirmed.) Set the output pin to the "meter" position and leave all others set to the "OPEN" position until you're ready to test.

For AND (NAND) and OR (NOR) gates, see Fig. 1 for normal operation and set the inputs of the gate to either "GROUND" or "1.5V" depending on the type of gate. Then switch "ON" the 4.5V and 1.5V supplies. Observe the meter for pickup or dropout of the output signal. Try all possible input combinations and make sure the output responds as required.

Many ICs contain two or more discrete circuits in one package so be sure to check all of them.

To check an amplifier (called "buffer") apply input signals and observe the output for straight through operation or inversion (output opposite input).

Flip-flops will be the most involved ICs to check out due to their varied functions. Truth tables for the two most common type of flip-flops, clocked J-K and R-S, are shown in Fig. 2. These are only typical truth tables so check the one for your particular device.

Understand the tables thoroughly prior to attempting to check a flip-flop as they can be ruined quickly especially if a positive voltage is inadvertently applied to an output that is in an OFF or DOWN state.

The R-S type merely requires setting up the various input combinations and observing the output Q or $\bar{Q}$ (Q not) to see that it follows the truth table. When checking flip-flops, always set the unused output (the one you're not metering) to "OPEN" as grounding either output will prevent flip-flop operation.

The J-K type is checked similarly except nothing happens to change the output state

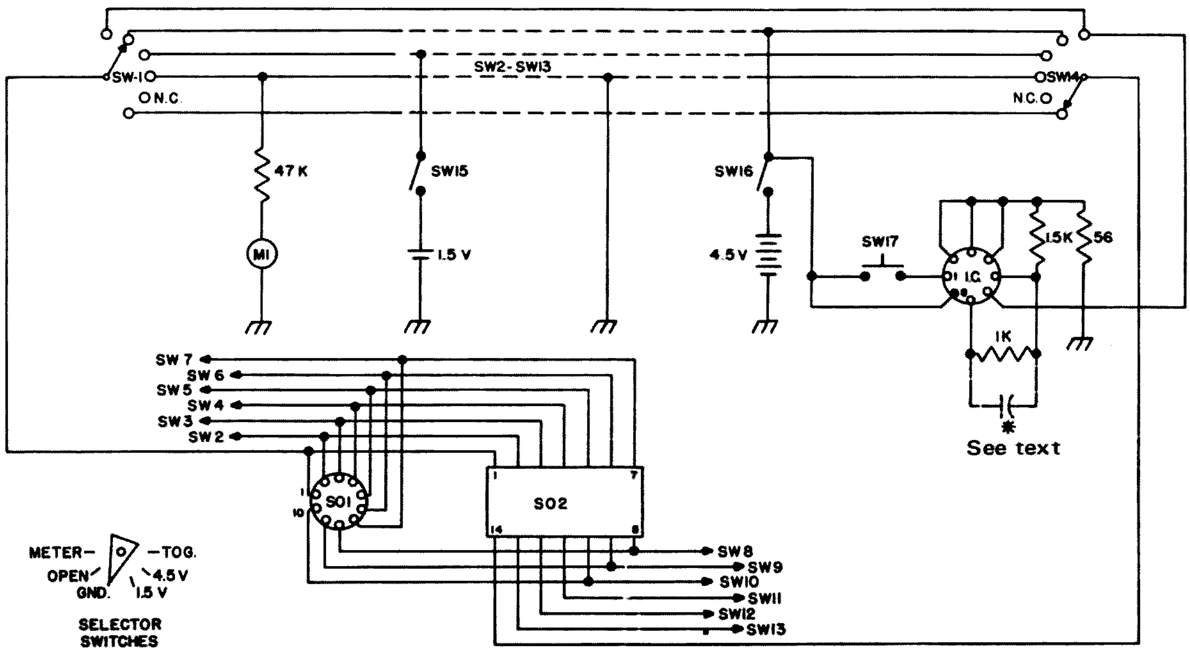


Fig. 3. IC tester schematic. M1–100 µA, SO1–10 pin IC socket, SO2–14 pin IC socket, SW1 thru 14–1 pole 6 pos. rotary, SW15, 16–SPST toggle, IC–µL 914, SW17–N.O. pushbutton.

until a signal is applied to and removed from the clocked input (usually labeled "T"). Therefore, the various input conditions are preset one at a time and after cycling (ON-OFF) the clocked input toggle button, the output is observed for conformance to the truth table. Most clocked flip-flops require a shaped clock input. A Schmitt Trigger circuit is included in the tester to provide the proper clocked waveshape.

Any flip-flop may have a direct set and/or direct clear input which override any other inputs. No matter what inputs or clocked signals are applied, a direct set (Sd) input sets the output (Q) high and a direct clear (Cd) input resets the output (Q) low. Be sure to check all these functions before declaring the device good.

The IC tester shown in Fig. 3 is simple and parts layout is not critical. Rotary or lever switches can be used for pin setup selectors although 6 position lever switches are hard to come by. Follow the switch sequence shown. If your Schmitt Trigger output does not operate a flip-flop toggle input consistently, add a 100 pF capacitor across the 1K resistor in the Schmitt Trigger.

If you have to switch an output pin through a voltage position (1.5V or 4.5V) during a test, turn the supply switches OFF until completing the change.

Any meter indicating 5 or more volts will work. I had a 100 µA meter on hand and series-mounting a 47K resistor with it resulted in a 5V movement.

The number and type of IC sockets depend on how many types you want to test. My tester has a 10 pin circular (works FB for 8 pin devices) and a 14 pin in-line socket. If you plan to test any 16 pin in-line devices, I suggest adding a separate 16 pin socket rather than trying to use a 16 pin socket for both 14 and 16 pin devices. This would throw off your selector switch numbering.

Flat-pack sockets are also available and its addition will be well worth while as flat-packs are becoming very plentiful on the surplus market.

I use a penlite battery power supply although a well filtered ac supply is just as good.

Conclusion

The use of ICs can help build up your shack accessory shelf with a minimum of construction time. By taking advantage of the IC bargains available today and eliminating frustrating hours of troubleshooting a project that won't work by checking the ICs beforehand, the "appliance operator" tag can be shed forever.

.. WA6IGU

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THE QSL FROM BY-LAND

Last summer, the Island of Okinawa was being subjected to a typhoon that was using its rains and wind to shut everything down. For two days I had been off the air because the antennas were lowered to prevent winds of 80 knots from turning them into a mass of tangled wire.

I was deeply absorbed in a rather old medical journal when the phone rang. An old pal of mine, Bob Martin, was sitting at the Naha airport, waiting for the weather to lift. He was 24 hours out of Burma and trying to get back to the U.S.

A 30-minute ride through pounding rain, several seconds of handshaking and back-slapping, a second ride of 15 minutes, and we were seated in a comfortable military club. After ordering drinks, Bob explained he had been working for the past three months in Northern Burma for a private geological firm. The pay had been excellent and armed guards had been provided for his safety.

He finished half his drink and began to unfold a story that still leaves me with a cold feeling.

"After being briefed in Rangoon for about three days, I was flown to Myitkyina in Northern Burma. I began my soil studies while the guards set about erecting bamboo huts. The first night we had visitors, but a few rifle shots from the guards dispersed our would-be thieves.

"For the first two weeks, the geological aspects of Burma kept me quite busy. As the routine began to slow down, I turned to ham radio. In the trunks and cases of supplies I had included one of the latest 2 watt, printed circuit transceivers which would run off one of the truck batteries.

"I had purchased this little QRP rig for a little 80 and 40 meter SWLing in the evenings. After a hard day of work, I'd bathe, dine on canned beef and rice and put my ear phones on for a few hours. The antenna was a thin wire strung from tree to tree with a length of about 60 feet. Forty meters was a mass of static, QRM and JA stations, so tightly packed they resembled a can of worms.

"One night on the low end of 80 meters, I heard a loud, T6 CW station testing. It must have been within a few hundred miles, but no call sign was given. The following night the same signal was on again, but the buzz and chirp was sending out Morse code . . . . de BY1**. I cannot use the call sign in its entirety because of later events that took place.

"On the third night he was there again, but there was a CQ followed by BY1** about twenty times.

"I had only three days left in Myitkyina (which is about 50 miles from the China border) and in a week I would be heading back to the U.S. Would I dare answer the CQ of a fellow ham? I spent the next day constructing a crude key from strips of metal and wood. A quick test showed that I was putting about one watt or less into my antenna on 80 CW.

"That night I waited to give BY1**/XZ. Not quite legal, but in this case the radio amateur spirit was beyond law.

"He came back to me. He was only able to repeat his call and something that came over as Ten—ng. A quick check on a map showed this to be Teng Chung, his QTH, which was about 75 miles east of me. I gave him my first name and QTH (I would be out

of there in a matter of hours). The QSO ended as his signal dissolved in a final chirp, a few buzzes and then silence. He appeared to be having rig troubles.

"I was a happy man that night as I drifted off to sleep. About 1 AM the guards fired a few shots at the ever present, but elusive thieves.

"The next night, I gave him another call. He was there all right, but his rig lasted only long enough for him to repeat . . . "QSL" . . . and then it stopped.

"On my last night, there was no sign of BY1**. I had less than 24 hours left before I was due to leave Burma and most of this time would be devoted to packing. Shortly before dawn, I was awakened by rifle shots, a rushing of feet and the guards yelling at me to come outside. They had shot and killed one of the thieves. The poor devil was dead beyond doubt, two shots in the chest had finished him. There was a small packet of papers in his pocket. I collected these and went into my hut to examine them under the kerosene lamp.

"Sorting through the crumpled and bloody papers, I received the shock of my life, for before me was a QSL card from BY1**. It was home made, had his name, QTH and was addressed to my call sign. The body lying outside was BY1** who had crossed the border to Burma hoping to deliver the QSL to me. I was physically sick for the first time in years, I wept.

"We buried him near the camp, his grave marked with a stone engraved with BY1**."

Bob Martin's story was finished. I was deeply moved, I had nothing to really say. I drove him to the airport and as he was preparing to board the plane he made a final gesture. He handed me the battered and stained QSL card of BY1**.

"Doc, you take this. Keep it out here in Asia."

I was about to argue with him that he should keep the QSL, but Bob dashed into the plane.

I had the QSL framed and keep it in my shack here in KA6 land. The next time you're in Okinawa, stop in, I'd be proud to show it to you.

. . .KA6IX

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A TWO-TONE SEQUENTIAL SELECTIVE CALLING DECODER

It beeps your horn . . . has a message lamp and sounds like something out of Star Trek.

OK . . . so the repeater is getting jammed up and all that nonesense is getting on your nerves. Squelch circuits have been acclaimed as the greatest thing since cheap monitor receivers. With noise pollution on the rise, some peace and quiet helps to produce less fatigue on the ears. Repeater cliques have developed to the point where a more sophisticated selective calling device might fill a very attractive need to those who require constant monitoring but without all the "chit-chat." The device to follow is interesting to use because it sounds so professional and works very nicely at a low cost. It can be made up for single tone decoding or a two-tone unit as is. Whatever you need, the small size and low power requirement will allow use with most modern two meter transceivers as well as a host of surplus mobile units.

The Alert Tone

When called by a fellow amateur, the only thing that happens is a three second LOUD warbling tone which triggers independently from the trigger tones and shuts down three seconds after the final tone. The first and second tones must be of a one second duration each. Any shorter and no trigger . . . any longer and the tone goes longer. During breadboarding a sonalert was considered, but because of high cost and size, it was given up in favor of the warbling alert tone. Using inexpensive import parts and a UJT, an alert tone unit is the result with a rather unique power oscillator for audio. The resulting signal is both pleasant and modern sounding.

The entire resting current for the alert tone is 2.5 mA and when signaling it runs about 25 mA.I was amazed at how loud the tone was for so small a current drain and checked it several times to be sure. The 33K resistor and the 25 μF capacitor in the UJT gate sets up a sawtooth pulse which is (slow switched) used to forward bias Q10 at the same rate. Since the frequency of this oscillator is dependent upon voltage, the base of Q10 varies the voltage feedback path to the audio transformer and a warbling rate is established. Any number of assorted alert tones may be selected by attaching a 10 μF capacitor to any of the components in the UJT to ground. Any attempt to switch this audio by anthing other than a relay was futile and resulted in a slow takeoff and a dying effect that sounded just awful. Since an extra set of relay contacts exist on the horn relay, it presented no problem to switch on the alert tone mechanically and the end result is a sharp "on-off" effect when receiving a call.

Frequency Selective Reeds

The decoder derives audio from the receiver from any convenient source either squelched or unsquelched (which makes the unit ideal for the Twoer). After clipping (if required) and suitable amplification from Q1, the emitter follower drives two G.E. Tone Reeds in series. My original experiment used this same set up for the Motorola Vibrasponder reeds although these are not really reeds.

The difference is that the G.E. reeds give a mechanical vibrating contact closure when

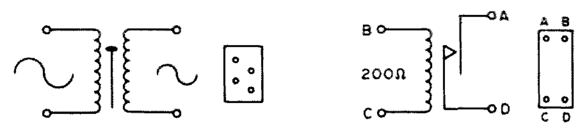


Fig. 1. Motorola and GE tone reeds.

the primary driving coil receives audio energy at the exciting frequency. In order to derive a usable audio waveform or pulse for decoding purposes, the G.E. Reed requires some switching voltage. It works very much like a synchronous vibrator, in that supplying dc across the normally open reed contacts, when vibrating, produces a very ragged waveform equal to the exciting frequency.

The Motorola TLN series of "reeds" (see Fig. 1) actually does the same thing but acts more like a frequency selective voltage generator. When excitation audio reaches the design frequency, a vibrating element which must be magnetized induces a very small voltage in a secondary coil which then can be amplified and rectified by later stages. Here the waveform is a pure sine wave. In any event, either reed can be used in the circuit and the pc board was designed to use the G.E. reeds because they are smaller, less expensive, and produce a gain over the TLN type. If the Motorola reed is to be used, eliminate the voltage drive and the RC filter and think of it as a transformer, grounding one side of the secondary and driving the .2 μF with the other side of the secondary. For two-tone operation the primaries may also be in parallel with the emitter of Q1.

As an after thought, the frequency selective relay used in remote control airplane work, will work very nicely and can be driven directly from the receiver speaker eliminating the need for Q1. These five-tone relays are available from Lafayette Electronics and require the G.E. voltage derived circuit. Since these relays tend to be lower in frequency, by carefully removing the tine mounting, the tine lengths can be filed to a higher frequency but don't go much beyond 800 Hz, because the contactor is mounted too far forward for a good "make."

The Basic Decoder

Once the frequency selective element has

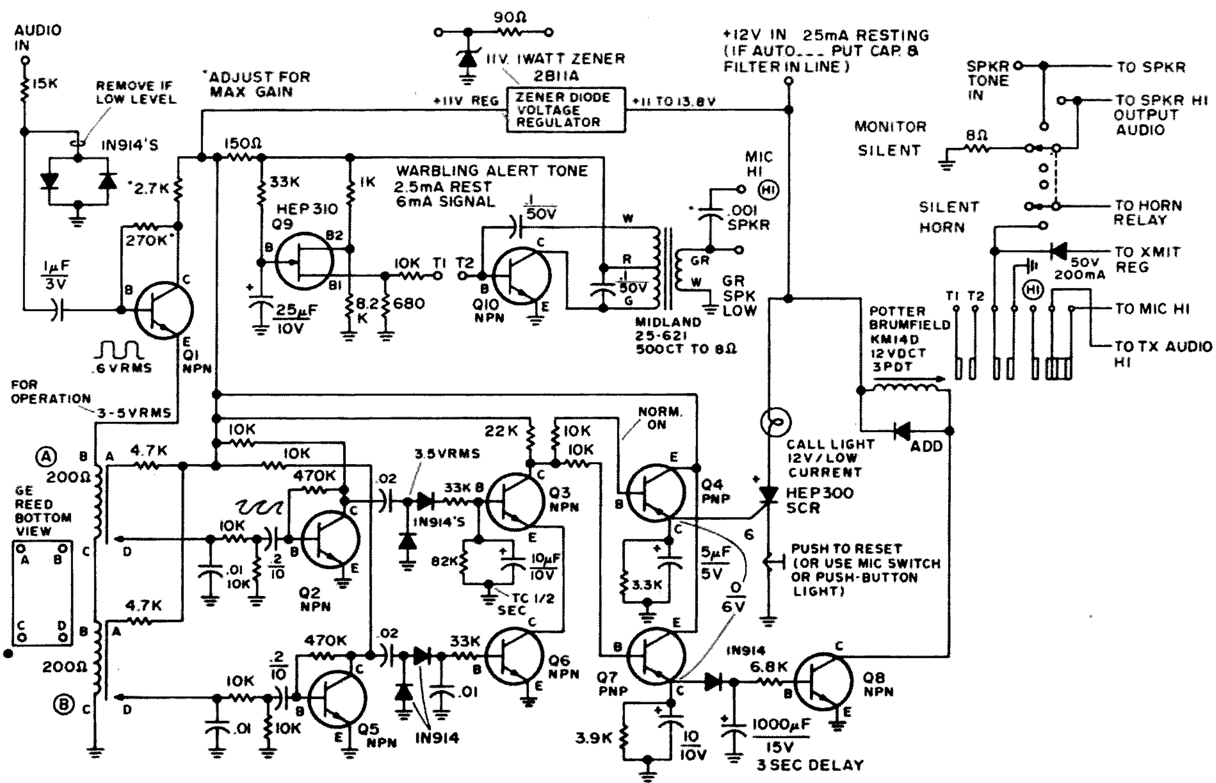


Fig. 2. Schematic of the decoder.

been selected, the corresponding output is amplified by Q2 (for tone A, the first tone in sequence) and rectified. Notice that a 10 µF and 82K time constant has been added to the first tone dc output. This RC network prevents trigger on anything but the proper tone sequence, allows Q3 to conduct long enough for the second tone to arrive through Q5 and Q6 . . . and prevents reverse tone signaling; i.e., where the tone sequence is reversed and the same two tones are used. This feature allows a simple two tone encoder to signal two decoders by alternating tone sequence, and permits a simultaneous "all-call" when the tones are sent together in a two second burst. Q3 and Q6 form a basic AND gate which only conducts when both tone signals have been received. Since this point is very brief, the result is a sudden dip in the outputs of Q4 and Q7 which cut off momentarily. When Q4 cuts off, emitter voltage increases sufficiently to fire the SCR and the lamp circuit.

Lamp current which must be in the "holding" range of the SCR will then hold the SCR "on" giving a call lamp. Other functions can be designed into this hold function such as starting a timer for a tape recorder.

The other control function also derives its voltage drop from Q3 through the other 10K resistor which provides isolation between the two trigger stages. Q7 uses a similar emitter follower which provides a healthy voltage spike from its cut off. Here the voltage passes through the diode, is used to charge the 100 µF capacitor and bleeds slowly through the 6.8K resistor holding Q8 into conduction for about three seconds. This type of delay circuit is attractive because it is inexpensive and is fairly reliable. The diode is required to keep the capacitor from discharging back through the emitter of Q7. The net result is a delay-relay which is activated by a one half second burst. If more time is required, increase the capacitance or, being careful to keep Q8 conducting, increase the bleeder resistor. Stretching this

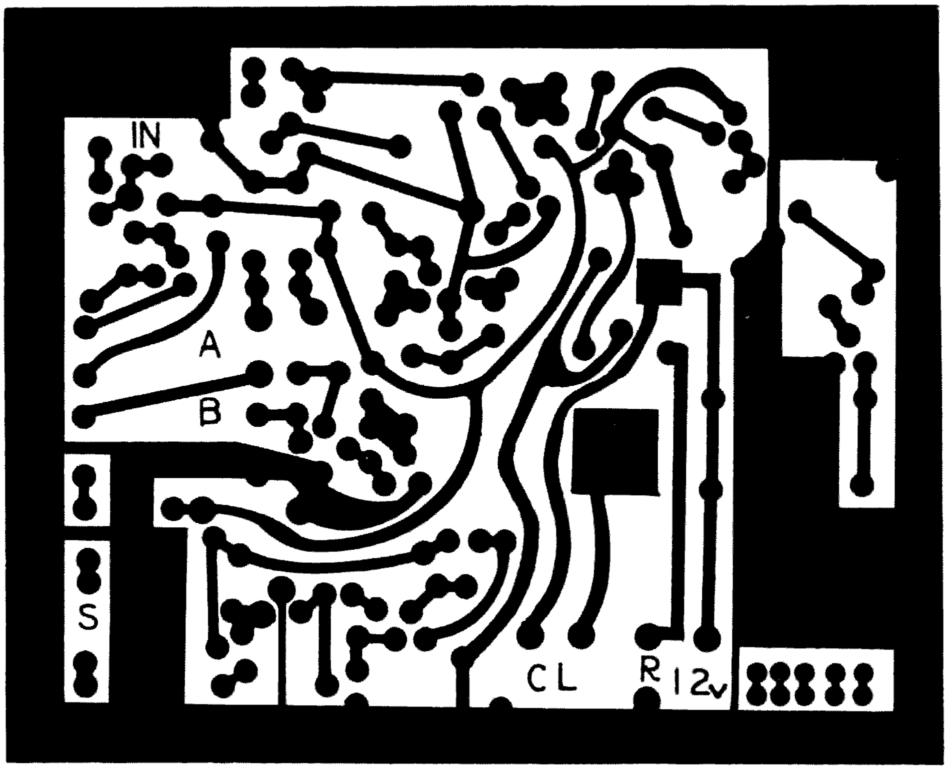
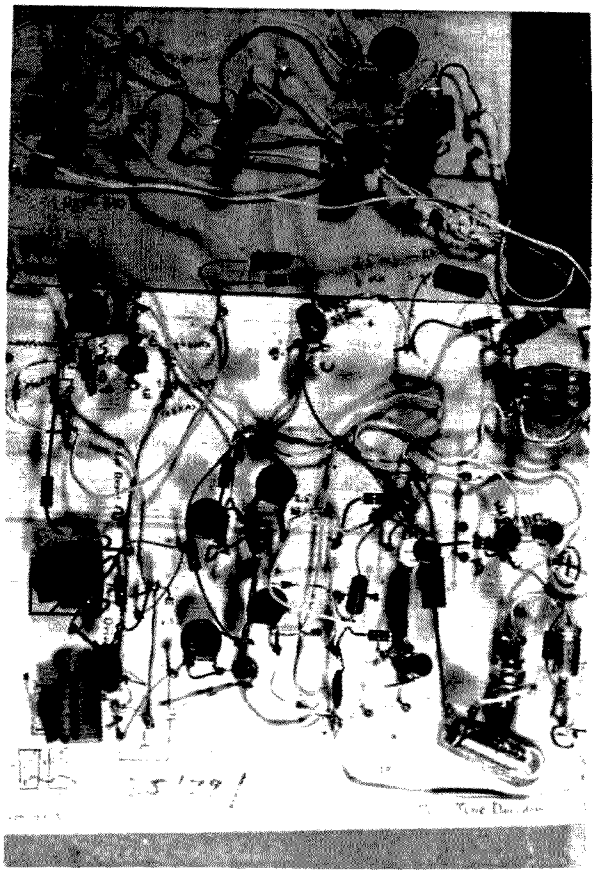


Fig. 3. PC board, actual size (foil side).

delay circuit to maximum with a 12V supply and a half second pulse, I was able to get about twelve seconds with the relay specified and a transistor of average beta.



W3JJU's original bread-boarding of the circuit.

Breadboarding The Final Design

The project was initially breadboarded. It was designed from basic transistor knowledge as I went along. I was surprised at how much fun it was to grab a piece of wood – pound a few wire brads in, and solder the parts together. Usually when trying out a circuit, I do everything without the board, ending up with a pile of soldered components which might have more practical value in an art show. Avoiding the electronic sculpture technique permitted the use of far more junk parts which were easily clipped in and out during experimenting. Breadboarding this way really saves time and is worth the effort.

The next step was to copy down the circuit, design the pc board and mount the parts. Throughout the design, only surplus capacitors and transistors were used. The transformer is a standard 500Ω to 3.5Ω and is made by Midland.

The board size will fit snugly inside most small receivers or control heads or can be side mounted in a box containing the horn switch, hook switch for the microphone and call lamp and reset button.

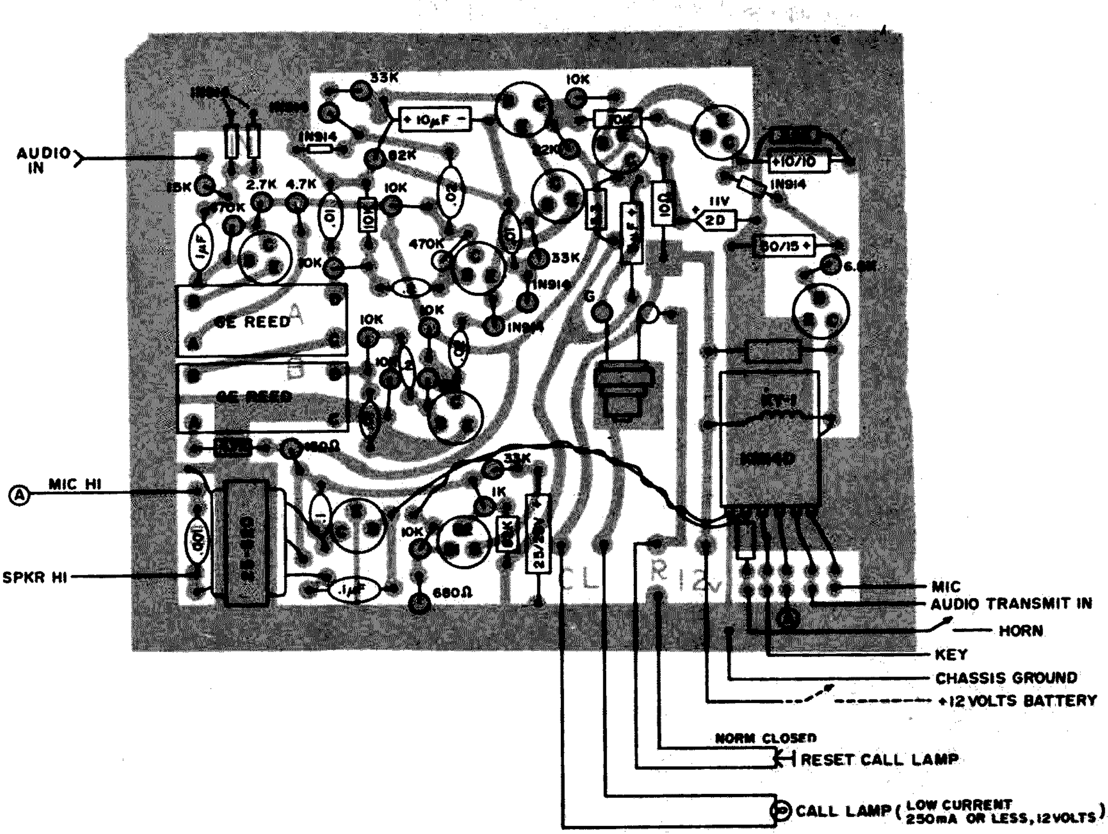


Fig. 4. Parts placement on the PC board.

Applications For The Decoder

Once constructed no adjustments need to be made – it either works or it doesn't. Check each stage of audio and measure dc. A good scope will point out the problem if any. All testing was with an old car battery and the heavy current stages, the lamp and relay, are isolated from the decoder through simple zener regulation. This helps to prevent falsing when starting the car or if car generators are hotter than the average. The Potter-Brumfield relay is expensive (about $5.00) but is very small for a 3PDT relay and provides many uses:

1. Connect one contact through a single pole switch to the horn relay in the auto. Connect the other contact to ground. When the decoder signals, the horn will blow for three seconds, and may be disabled with the switch.
2. Likewise, the SCR can switch on the dome-light for nighttime silent alerting and may be cut with a switch.
3. Shunt the audio output from the receiver to speaker through an 8Ω resistor and drive the speaker with the decoder alert tone. Use a microphone "hook switch" so that when the microphone is "on-hook" the speaker is muted. You now have the same type of system as a home telephone.
4. I haven't checked the legality (and I don't intend to use this) but some mobile services other than amateur use a call verification signal. This can be provided by keying the transmitter from the decoder relay, and switching the warbling tone to microphone input. When signaled, the mobile unit switches on and transmits the last two seconds of the warbler so that the calling party knows that received party has his unit on and his call was received. If nothing comes back, don't bother wasting airtime calling. His unit is probably off.

It was mentioned earlier that the unit could be used with a single tone. By using one reed and grounding the emitter of Q3, the decoder will respond to a one second single tone burst. Building and using a decoder can provide an interesting and professional touch to an average "open mike" repeater system. It reduces the strain of increased VHF activity, which should reduce the complaints. After all if you don't hear 'em, you don't have to work 'em!

. . .W3JJU

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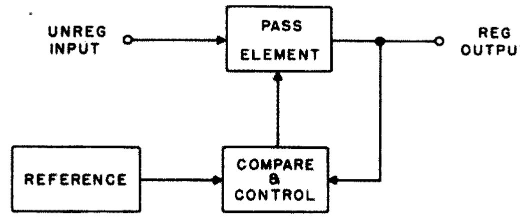

Fig. 1. Elements of a series voltage regulator.

A BASIC VOLTAGE REGULATOR

Remember transistors? They do a fine job when ICs aren't handy.

One of my recent electronic efforts was full of TTL devices and needed a regulated five volt supply. A search through the junk box showed that I was out of my usual collection of IC regulators. I don't know about your junk box, but if it is anything like mine it concentrates on the fundamentals – the essentials: transistors, resistors, capacitors and little else. Every so often I have a fairly good stock of ICs but unknowingly, some innocent project always depletes my supply. This, I realize, is evidence of inefficiency. C'est la vie. Another check indicated that my zener diode supply was in no better shape.

Naturally, I had drawn schematics and sketched pc board layouts before I found that I had no parts to fit, but all that work at least makes you think a little about how a circuit works. And a voltage regulator minus frills really only consists of a few elements. A pass element, usually a transistor; a reference element, generally a zener diode; and a comparison and control amplifier which compares the output voltage with the reference voltage and whose output then causes the pass transistor's resistance to vary in such a way as to keep the output voltage constant. See Fig. 1. The frills, although sometimes necessary, (current limiting, temperature stability, rapid response, etc.) were not really needed for my application.

There was no parts problem with the control amplifier and pass element since I was liberally stocked with transistors but the reference element was the stumbling block. In Fig. 2 the current/voltage diagram illustrates the operation of a diode in both the forward and reverse conduction regions. A zener diode depends on the reverse conduction region for its operation; when the reverse voltage across the diode exceeds a certain value the diode breaks down and the voltage remains constant for wide ranges of current. In order not to destroy the diode the current must be limited to a safe value by a series resistor. For example, if you had a one watt zener diode and the breakdown voltage was ten volts then the current must be limited to 1/10 ampere or 100 mA to stay within the power rating of the diode.

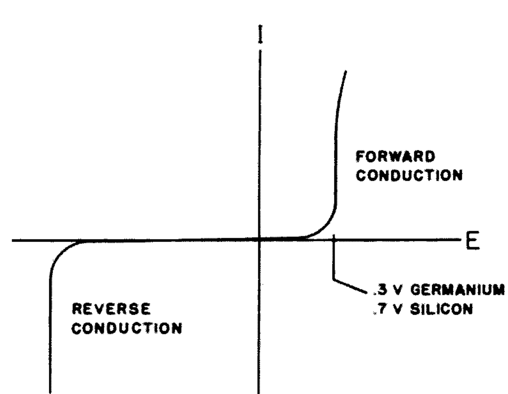

Fig. 2. Junction diode current/voltage diagram.

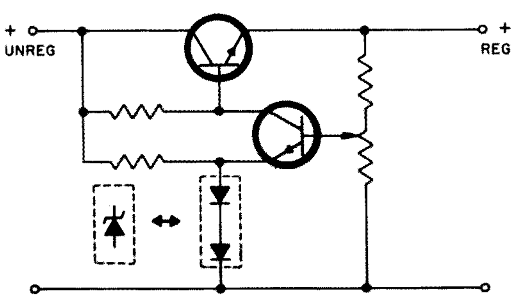

Fig. 3. Forward biased diodes replace zener diode as reference.

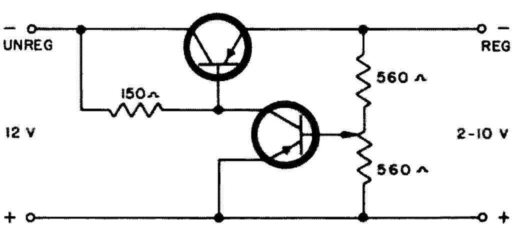

Fig. 4. Base-emitter voltage as reference.

Also for a wide range of currents a diode shows a relatively constant voltage drop in the forward conduction region. This voltage drop is about .3 volts for germanium and .7 volts for silicon diodes. Slight variations in this voltage are due to the current through the diode, the temperature, and the doping of the junction material but it can be a good stable voltage which may be used for a voltage reference. So if you want, you can replace a zener diode with a string of forward biased diodes to get the reference voltage you need, as in Fig. 3.

It is possible to go one more step in this direction and wind up with the voltage regulator I used, which is illustrated in Fig. 4. This circuit utilizes the forward biased base-emitter junction (a diode) of the control amplifier as the reference element and reduces the component count to a satisfying minimum. I used PNP transistors to get a negative regulated voltage, but NPN transistors could be used to obtain a regulated positive voltage output. If additional regulation is desired another stage could be added to the control amplifier. A common way of accomplishing this would be to darlington connect a transistor to the pass element. However, in such a situation, I would recommend going the IC regulator route.

. . .KL7EVO

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TAKE-APART 2 METER BEAM

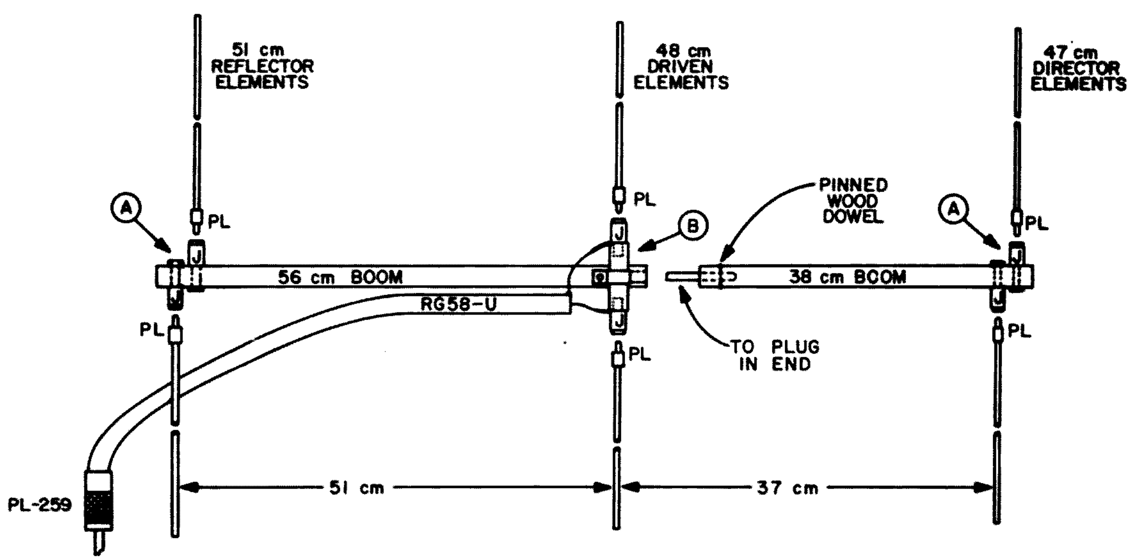

Fig. 1. The 2 meter beam. All elements are measured from center of boom.

Here is a portable, take-apart two meter, three element beam for FM that can be disassembled and stuffed into a long umbrella case for ease in carrying around. It stirred up the Boston area boys and they wanted more information on it. It features simple construction using junk box parts and is FB for walkies and portable operation. Supporting the beam may be done by various methods. Some have used rope to hang it from the ceiling, attached it to swinging doors, pasted it on the wall, or, in the case of Tony K1VTE, on his shoulder while walking around with his Tempo, ignoring the wild-eyed onlookers.

The main boom and the take-apart extension was scrounged from ½ in. (std) aluminum tubing – which in our case were the leg supports from a discarded portable metal snack table. If you have any of these around the house, maybe the XYL will donate one for the cause. The six elements are from 1/8 in. (std) brass rod with the ends threaded 6/32 to fit into the banana plugs. They could also be soldered in. Millen #37222 binding posts are used for the jacks, and fitted in the holes in the boom and secured

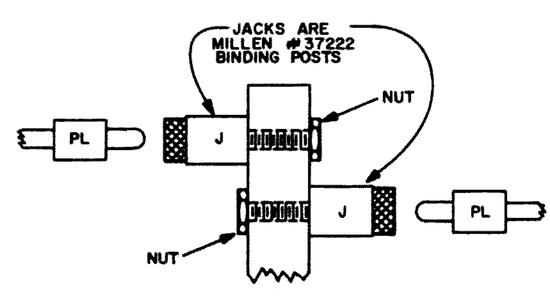

Fig. 2. Details of end elements.

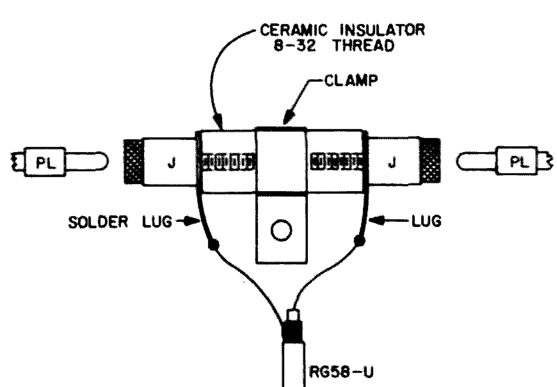

Fig. 3. Driven element details.

with 8/32 nuts. The slight offset of these jacks at each far end of the boom does not materially affect the performance. The ceramic center insulator is a surplus unit with 8/32 threaded holes to accommodate the binding posts. The threaded ends of the posts are shortened a bit so they will screw down tight to the center insulator, securing solder lugs or clips for the coax feed.

It works like a charm and the compactness is a bonus for people who travel.

. . .W1BHD

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MAKING THE MOST OF AUTOMATIC IDENTIFICATION

Wayne's editorial in the September 1972 issue lit my fire when he got to automatic identification. I've been talking up an automatic calling and alerting system for a long time, and it looks to me as though one black box could do the ID job as well. The requirements are very similar. I pulled an old paper out of the files, and it still looks relevant.

Briefly, the idea is to set up a single calling frequency in each band. Anybody wanting to contact a specific station would send a digital word giving the calls of the station called and the station calling, in a coded form. An autocall-equipped station would have a black box connected to the receiver, constantly monitoring the calling frequency. It would ring a bell when it recognized its call.

Most of the logic required to transmit a digital call is the same as that needed to receive it, so it makes sense for one unit to do both. Now we throw in the self-identification (SID?) function, and the unit proceeds to take over the transmitter whenever the rule says it should. It sends only the half of the autocall transmission that contains identification. Naturally, this happens on the working frequency.

Since identification comes right after the start pulse in the SID transmission, it makes sense to invert the traditional ham calling procedure and begin the autocall transmission with the identification. Makes the logic simpler.

A standard, machine-readable form of calling and identification opens up all sorts of possibilities. Besides the DXpedition speed-up, there are DX autopatch, distress call monitoring, computer-controlled real-time Teletype traffic nets, automatic repeater chaining, and whatever else a quarter of a million fertile and fiendish minds can invent. I would like to make a partisan statement at this point, to the effect that I have only emotional sympathy for those who would like to freeze ham radio into the techniques and atmosphere that built it through the twenties and thirties. It's always been fun, but a little judicious use of automation could turn it into a really useful and dependable emergency communication system for the public, which has always been an unfulfilled dream. What we have now is analogous to a telephone with no bell.

The rest of this article is the meat of the original paper on the autocall code, slightly modified to take SID into account.

The idea is to encode a ham call in a way that is easy to learn, while keeping the hardware simple. This way, we eliminate the need for a catalog to relate a call to a binary number.

Morse code can be rejected out of hand. Those variable character lengths would make the hardware pretty complicated. We want a fixed-format binary code, then. Most of the character positions are letters, so 5 bits per character should be enough. This immediately suggests Teletype code, but this has problems. The LTRS and FIGS characters required would add to the length of the call without carrying any information. The code itself has no rhyme or reason, and this would create difficulties in the use of a very simple autocall box in which the operator must manually encode the call of the station to be alerted.

In the code proposed here, we make use of the information about the format of a call that is implied by the fact that we are

dealing with a ham call. We know that every call consists of a prefix and a suffix, that the suffix consists of one to three letters, and that the prefix consists of a digit preceded by one or two letters or a digit and a letter. Every character except the first is known in advance to be a letter or number by its position in the call, and hence this need not be sent. All we need is an extra bit to resolve the question about the first character. We take care of the fact that some calls have less than the maximum number of characters by defining a code for space.

In Fig. 1, we begin by assigning 5 bits to each of the 6 characters that make up a call. The first character of the call always gets the first character of the prefix. The last digit of the prefix, which is always a numeric digit, goes to the third character. If there's a letter between the first character and the digit, it goes into the second character of the call; otherwise a space goes there. The suffix begins with the fourth character, and continues until all letters are encoded. The remaining characters are filled with spaces. The King of Jordan uses three spaces, obviously. The third character can only take on ten values, so it can make do with 4 bits. On the other hand, the first character can be either a letter or a number, so it can have 36 values and hence needs 6 bits. So we borrow one. The high-order bit of the third character becomes the FCN, or "first-character-numeric," bit. When it is a 1, it indicates a call that begins with a number.

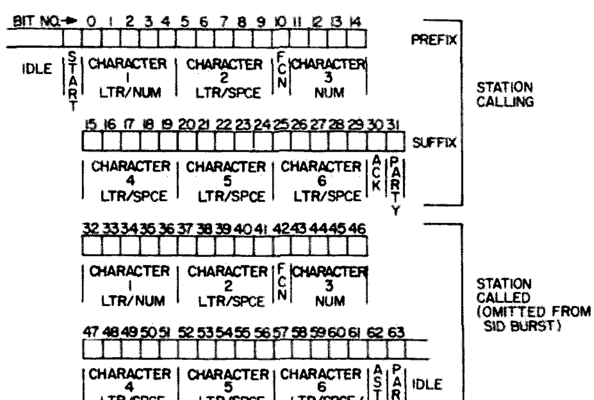

Fig. 1. Proposed autocall and SID word format.

We have assigned 30 bits. Logic hardware likes to work with numbers that fall on powers of 2. The next one would be 2^5 or 32. It's easy to find worthwhile things to do with 2 more bits. We use the last one for a parity bit, to help a receiver identify and reject a call that had one bit altered by noise. This leaves one. Two, really, because there are two calls in the whole transmission. I would assign the one in the identification call to indicate acknowledgement of a previous autocall or autostart transmission. The one in the other call would tell whether the purpose of the transmission is to signal the operator or start equipment to record an incoming message. 1-bits would indicate ack and autostart, respectively. Parity should be odd; that is, a 32-bit group should contain an odd number of 1-bits.

Now let's turn to Table I, which defines the binary code. Basically, the letters are numbered from 1 to 26 and written in binary form. Number 0 is a space. For numbers, the values 0 through 9 are simply written in binary form. Four additional bit configurations are defined for the sixth character of the station called; these are used for things other than a call to a specific station. They are recognized by 1's in the three left-most bits. The first two are for group of symbolic calls, such as alerting nets or obtaining some service that might be provided by any of a number of stations at different times. The other two special codes are for radio control.

I would suggest that alpha calls be assigned to nets and other groups of stations on request, through a trustee or other officer. These should go in the callbook or net directory. Beta calls would be symbolic calls, designating a function and location. It should be possible to assign many of them in a systematic way, such as by state, county, or metropolitan area, and by service provided. Examples: WA6AC-alpha might convene an emergency net in Alameda County, and WP2NY-beta might be a request for a phone patch into New York City. Some group calls would transcend national boundaries; I would suggest using zero in the first and third characters for these. A good example of this would be a worldwide distress call, which might be coded as 0Q0RR-beta.

Table I
BINARY CHARACTER CODES

Character	Char. 1 F C N	Char. 2, 4, 5, 6	Char. 3	Char. 6 of station called
Space		00000		
A	000001	00001		
B	000010	00010		
C	000011	00011		
D	000100	00100		
E	000101	00101		
F	000110	00110		
G	000111	00111		
H	001000	01000		
I	001001	01001		
J	001010	01010		
K	001011	01011		
L	001100	01100		
M	001101	01101		
N	001110	01110		
O	001111	01111		
P	010000	10000		
Q	010001	10001		
R	010010	10010		
S	010011	10011		
T	010100	10100		
U	010101	10101		
V	010110	10110		
W	010111	10111		
X	011000	11000		
Y	011001	11001		
Z	011010	11010		
0	100000		0000	
1	100001		0001	
2	100001		0010	
3	100011		0011	
4	100100		0100	
5	100101		0101	
6	100110		0110	
7	100111		0111	
8	101000		1000	
9	101001		1001	
alpha				11100
beta				11101
gamma				11110
delta				11111

The gamma codes would be used to trigger remote-control functions, where uniqueness of codes is important. Presumably the Commission wouldn't want to be stuck with issuing them, but perhaps the

League or some volunteer committee could do that. The delta codes would be for anybody's use, and depend on probability to keep from activating somebody else's black box. Any combination of bits with a delta in the last character is okay, as long as the parity is odd.

This code is a close relative of ASCII, which would be handy in the design of computer-controlled message-handling equipment.

An NRZ keying scheme similar to Teletype should work out well, provided all units have the same clock rate within half a percent or so, which is easy enough. The transmission would begin with a system idling at logic 0 long enough to establish AVC levels and otherwise initialize the receiver. Then it would go to logic-1 for one clock period to start the decoder. The following 64 clock periods would each be assigned to a bit, and contain either logic level. After that, the system would go back to idling condition for at least 2 clock periods, if several stations are being alerted together, or drop out of autocall mode and perhaps go to receive. In an SID burst the transmitter would go back to normal operation after 32 data bits.

I'm not sure how the FCC plans to module the SID pulses to achieve compatability with all transmitters. FSK won't work with most CW and AM rigs, and few FM rigs have any CW capability. Subcarrier methods won't work with CW-only rigs. I suppose CW would be the easiest adaptation, since grid-block keying is a relatively easy modification. A 5-mS SID burst would still present problems with a CW or FSK station, because the fast keying rate would require much more bandwidth than the normal signal. Slowing it down would most likely cause annoying interference to the main signal. A warning light half a second before the SID takeover might help, plus an interlock line to the Teletype tape reader.

Frequencies need a little thought. Any service that operates on a recognized frequency should have its autocall receivers on that frequency, not on the calling channel. A net that uses the autostart feature as a selective squelch should do it on the NCS frequency, at least while the net is in session.

Operation on the calling frequency should be minimized. In fact, it might be a good idea to set aside a second frequency for establishing contact and agreeing on a working frequency. If the service gets popular, it might even be necessary to set up several contact frequencies, and make the choice between them according to the third character of the station called. (The station called is the only piece of information that will always be known to both stations, even in the case of a primitive autocall decoder.) The use of the autocall frequency for autostart and actual transmission of messages should be reserved for emergencies.

We need one accurate oscillator, to set the keying rate. It would be nice to have that oscillator control everything, so one adjustment does it all. This means that every frequency in the system should be a multiple or submultiple of the master oscilaltor. Similarly, the oscillator should be a multiple or submultiple of WWV. 2.5 MHz is a submultiple of all HF broadcasts, but not every ham band contains a multiple of this frequency. 100 kHz would be better. This is still not a submultiple of the 60 kHz broadcast, but a digital divider could generate 10 kHz, which is. Therefore, I suggest that the autocall frequency in each band be a multiple of 100 kHz, and the keying rate be a submultiple of 10 kHz. The contact frequency should be 10 kHz from the autocall frequency. Naturally the standard could contain a high-frequency crystal oscillator to save space, and divide it down to 100 kHz.

This autocall system can do more things than most people would want. There would be a need for a number of different kinds of units, with varying features and levels of sophistication, from the basic SID box to the NCS's unit that can call any of dozens of stations at the push of a button.

I've deliberately avoided discussing the nitty-gritty of hardware in this brief article. The first priority is to figure out what we want to do, before the FCC hands us something that doesn't fit our needs. The traffic and phone patch people should have some relevant comments, in particular.

...K6HKB/1

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CHOOSING AND USING AN ELECTRONIC CALCULATOR

Having watched the prices of electronic calculators drop drastically in the last year or two, I finally decided to splurge. It was a tricky decision, since in a falling market you hate to buy something if you suspect that a month later you'll be able to get it for half the price. Still, I finally decided that prices were close to the bottom (which wasn't quite correct) and took the plunge. I've now been using my little gem for almost a year, and hardly a day goes by that I don't use it for something or other (I don't doodle, so sometimes I just sit at my desk and play with the calculator, finding the square root of my phone number. . .).

If you have been thinking of buying one, or already have one and want to know how to use it better, then read on. Here's the real story.

If you still don't have one, then go out and buy one – otherwise this article won't make much sense to you. But first, you'll have to decide just how much of a calculator you want. The most common ones, sold all over the country, have four basic functions – they add, subtract, multiply and divide. That's really all you need, but if you pay more you sometimes get more (not always). The Cadillac of them all is a $400 unit made by Hewlett-Packard, the HP-45. In addition to the four basic functions, this one also finds sines, cosines, tangents, inverse sines, inverse cosines, inverse tangents, both common and natural logarithms as well as antilogs (powers of ten and exponentials), squares, square roots, reciprocals, factorials, percentages, percent differences, sums of squares, mean and standard deviation. But that's not all – it converts from degrees-minutes-seconds to decimal degrees and backwards, it converts from polar coordinates to rectangular coordinates and back, it converts from degrees to radians and back, it converts from inches to centimeters and back, kilograms to pounds and back, liters to gallons and back. It lets you work on two sets of numbers at the same time, it displays pi (3.14159), and probably does a dozen other things as well – all at the touch of a button. It's a battery-operated unit that fits your pocket, and is an engineer's best friend. They call it an Electronic Slide Rule, but it really does much more than that. To extend the ease of use for engineers and scientists, this unit includes circuitry for scientific notation – the use of multipliers (powers of ten) for very large and very small numbers. All in all, a great device.

Another Hewlett-Packard calculator, at the same price, is a business model which finds percentages, interest rates, markups, rounds off to the nearest cent and even finds the number of days between any two dates.

If you think $400 is too much, then a drop to $300 gets you either the HP-35, which does about half as much as the HP-45 (that's still a lot, though) or an MITS desk-top unit that's roughly comparable.

For engineering calculations, the Hewlett-Packard and MITS units are the

only widely advertised units that have all of the trigonometric, exponential and hyperbolic functions you might need for really serious calculations. But there's no reason to spend that much if you are a non-professional – for amateur and household use the only functions that you will use fairly often (besides the basic add, multiply, subtract, and divide) are the reciprocal and square root. If you want to spend about $100, you can get a Texas Instruments or MITS unit that is also small enough for a pocket, and which does reciprocals and square roots. But even that's a lot of money.

That finally brings us down to the common type of calculator, the one that most hams can afford. So let's talk about that.

First, they come in various sizes. The table-top models, being line-powered, can afford to use big, bright readouts and big keys. The pocket models (you sometimes need big pockets) are perhaps $10 to $30 more expensive, and use tiny readouts that may be hard to see, especially in a bright light. Some come with rechargeable batteries and (usually) external chargers. But watch out – the very cheap battery models often use non-rechargeable batteries which don't last very long. They may seem cheap to start with, but you may go broke buying batteries.

Talking about readouts, most table-top units use ½" or larger displays, such as the Sperry or Burroughs neon readouts; most pocket units use ¼" LED (light-emitting-diode) readouts. One portable unit (the Lloyd, also available under other names) uses a liquid crystal readout. Aside from the fact that this type of display has (at this time) a limited life, the Lloyd calculator is very large and uses non-rechargeable D cells. The liquid crystal display is also hard to see. When and if liquid crystals become cheap and good, they will really cause a revolution in calculator design, since they take very little power, and even dry cells will last a long time.

The next thing to consider when choosing a calculator is whether it has a fixed or floating decimal point. In a fixed-point calculator, the position of the decimal point is either fixed in the design, or else set by a small switch at one of several places. In a floating-point calculator, the decimal point will automatically be placed by the machine in the best place, depending on the number. Basically, the fixed-point models are good for dollars and cents, and the floating-point models are good for everything else.

Using a fixed-point calculator for dollars and cents is handy, because you can always select exactly two decimal places in all of your numbers, and also because most of these models will round off to the nearest cent. For instance, if you figure out the sales tax, say 6% on $1.63, a floating-point calculator will give you an exact value of $0.0978, while a fixed-point machine will round that off to $.010. This is good for money, but not if you are going to calculate capacitor values.

The most useful choice is then a machine which allows you to select either fixed or floating mode (and many, such as the $80 Heathkit, give you that choice); but if you have to go one way or the other, then the floating-point is the better choice.

Just to show you how bad the fixed-point is, suppose you want to find reactance of a 10 μF capacitor at 60 cycles. Using the formula

$$XC = \frac{1}{2\pi f C}$$

You practically have to stand on your head to do this on a fixed–point machine because 10 μF is actually 0.00001 farad (remember, the formula holds for farads,) and most fixed–point machines won't let you enter that 0.00001 as a number – they simply round it off to something like 0.00!

On the other hand, if you use a floating-point calculator, you just take 1, divide it by 2, divide that by π (3.14159265), divide that by 60, and finally divide that by 0.00001, to get 265.25 Ohms. And if you do it slightly

differently, you can get an even more precise answer of 265.25823 Ohms, though it probably won't do you much good.

Another feature to look at is the number of digits you get. Most inexpensive calculators have eight digits plus one more for either a minus sign or an error indication. You can save a little money by getting only 6 or even 4 digits, but at a tremendous loss of convenience. A small number of digits is really not enough for serious calculating. The manufacturers know this, and usually include circuitry for doing calculations on longer numbers, and then displaying just part of the number at a time. For instance, what may be the cheapest machine yet is a small Sharp unit that sells for $38 in Japan. It offers 12-digit calculations – fixed point, with nine digits before the decimal point and three after – but only three digit display. To see the whole 12 digits, you have to hit a special key that lets you see three digits at a time. As far as we're concerned the dollar saving isn't worth the effort.

But some units advertise "8-digit display, 16-digit capacity." This doesn't usually mean what it sounds like. You probably think it means that you can use numbers up to 16-digits longer, but that's not so. You can still only use 8-digit numbers, but you can get 16-digit long answers though only accurate to the left-most 8 places. An example will display what we mean.

Suppose you want to multiply 12345678 times 599, which has a correct answer of 7395061122, but using an 8-digit machine. The answer is 10 digits long, so what happens? Some machines just stop and don't even try it. Others will do it, but only display the left-most 8 digits of the answer. (A very few will let you press another key to see the right-most digits.) But a "16-digit capacity" model will display the answer as 73.950611E; if you know how to read it you're ahead. First of all, the E means error – you've done something you shouldn't have. The digits 73950611 are the first 8 digits of the correct answer. And finally, the decimal point tells you how big the answer is – the instruction manual says to move the decimal point 8 places to the right – adding a few zeroes if needed – and you get the answer as about 7395061100. And that's at least close.

A worthwhile feature is a constant key. Essentially, this key lets you enter a given number (called the constant) into the calculator for use over and over in succeeding calculations. In most calculators, this constant can only be used in multiplication or division, though in some it can also be used to add and subtract. This feature is of great help, for instance, in calculating crystal frequencies if you're an FM fiend.

Suppose you have a pile of 18 MHz crystals, and you want to see what 2m frequencies they will transmit on. Since the multiplication factor here is 8, you push down the K (constant) key, and key in the number 8 x, which sets up the constant function for a multiplication by 8. To find the frequency of an 18 MHz rock, just enter 18 =, and you get the answer 144 MHz. To find the transmit frequency of an 18.3675 MHz rock, just key in 18.3675 =, and the answer pops up as 146.94. Notice that you don't have to reenter the 8 x again.

In division, you can use a constant divisor. For example, you have to order a few transmit crystals for a 450 MHz transmitter that uses a crystal multiplication factor of 36. To get the crystal frequencies, first push down the K key, and enter 448.55 ÷ 36 = and the answer comes up 12.459722 (we sure hope you have a floating-point machine, since a fixed-point calculator will come up with 12.46 which is about as useful as doing it in your head). For the next crystal just enter 445.05 = and the answer appears as 12.3625. For more crystals just keep going in the same way.

You can do a whole series of divisions, using the *same divisor*, very fast. But notice that this scheme doesn't really help you very much if you have to order receive crystals, since you can't use the constant feature if you first have to subtract the i-f frequency and then divide. Although everyone ballyhoos the constant feature in their ads, it isn't really that useful in most calculations.

But the constant feature is useful in doing a trick which sometimes is very handy. If you remember a few paragraphs back we mentioned that reciprocals and square roots are important. Well, many units that have a

constant allow you to get reciprocals by pushing a certain sequency of keys. This, and a related trick for squaring, are not advertised and don't work on all cheap calculators. But if it works on your unit, then more power to you – you are about to save yourself a lot of work.

First the trick for squaring. Suppose you want to square a number like 9. Normally you'd have to push 3 x 3 =; that is, multiply the 3 by itself, which would then give you the answer of 9. Notice how you have to enter the 3 twice. But on some calculators, when you push the first 3 x, the 3 goes into an internal operations register, and *also still stays on the display.* Keying in the second 3 is then really a waste, and if you go directly to the = key, you will get the square, 9. It doesn't really make much difference with 3, but suppose you want to square something like 3.1622777 – it makes a big difference whether you have to enter the number once or twice. The trick now – and remember, it will not work on all calculators – is to just key in 3.1622777 x = and you get the square. This is a worthwhile trick to try in the store before you buy your unit, since if you use your calculator for electronic calculations you will often have to find square roots – and the best way of checking the square root is to square it, right? The reason they don't advertise it is that it is really a byproduct of the design – not something purposely designed into the calculator.

And now to the reciprocal. Suppose you want to find the reciprocal of a number that's on the display – you may have just calculated it, and now want to find the reciprocal. The obvious way is to write it down, and then key a 1 and divide by the number you have written down. But note that this requires an extra step – you have to write down the intermediate answer. (By the way, this is where a calculator with memory may be of some advantage, but you don't need it.) The trick for finding a reciprocal without actually doing the division into one is similar to the squaring trick. First, starting with the number whose reciprocal you want to get on the display, push down the K key and then hit ÷ =. Just as hitting x = in the squaring trick multiplied a number by itself, so hitting ÷ = divides the number by itself, and so you get a display of 1. But since you're set to constant, doing this also sets the calculator for a constant division by the original number. If you now turn off the constant feature by releasing the K key and then hit the = key one more time, you actually do that one last division and get 1 divided by the original number – the reciprocal.

Now, why is the reciprocal so useful? Let's show you with an example. Suppose you want to find the equivalent resistance of two resistors in parallel, one of them 12K and the other 68K. The well-known formula is the "product over the sum,"

$$\text{Equivalent R} = \frac{12\text{K} \times 68\text{K}}{12\text{K} + 68\text{K}}$$

The problem is that you first have to add up the two resistors on the bottom, save that answer, then multiply out the two resistors on the top and divide by the sum you've saved. If you have a calculator with memory it's easy to save that intermediate answer, but otherwise you have to do it separately and write it down (though in this case it's easy to remember, 80K). But with the reciprocal you do the problem backwards:

$$\frac{12\text{K} \times 68\text{K}}{12\text{K} + 68\text{K}} = \frac{1}{12\text{K} + 68\text{K}} \times 12\text{K} \times 68\text{K}$$

See, you break up the problem like this: First add 12K to 68K to get 80K. Then find its reciprocal (0.0000125) and right away multiply it by 12K and by 68K.

Well, now that we've covered the most important features of the common garden-variety of calculator and some of the tricks we can do on some of them (hint – if you haven't bought a calculator yet, take this article with you when you go and try out the squaring trick and reciprocal trick in the store to make sure you get one that works) let's look into more tricks for making our calculations easier. Let's go back to the parallel resistor problem,

$$\frac{12\text{K} \times 68\text{K}}{12\text{K} + 68\text{K}}$$

and let's do it the long way. 12K + 68K on the bottom is 80K, so we'll write it down.

Now let's multiply 12K x 68K. Oh, your calculator doesn't have a KΩ key? Well, of course K means 1000, so 12K becomes 12000 and 68K becomes 68000 when you key in the numbers. Good, here we go.

$$12000 \times 68000 = 8.1600000E$$

Hmmmm! The product happens to be over 8 digits long, and so we got that funny readout. Now what? A good thing to remember is that our formula will work for Ohms, kilohms, megohms, even milliohms. Just make sure that all of your resistors are expressed in the same units, and the answer comes out in the same units. What this means is that we can skip the K and do this:

$$\frac{12 \times 68}{12 + 68} = 10.2$$

omitting all the K's, and this gives us an answer also in K. Hence the answer is 10.2 KΩ.

As another example, suppose you put 100 K in parallel with 1 MΩ. Since 100 K is .1 MΩ, you could do the calculation like this:

$$\frac{.1 \times 1}{.1 + 1} = \frac{.1}{1.1} = 0.090909 \text{ M}\Omega$$
$$= 90.909\text{K}\Omega$$

Still another way of doing the problem is to note that, though the formula says "product over the sum," we don't have to do it just in that order. We could break up the original problem like this:

$$\frac{12K \times 68K}{12K + 68K} = \frac{12K}{12K + 68K} \times 68K = \frac{12K}{80K} \times 68K$$

Doing it in this order keeps the numbers from getting too big. 12K divided by 80K (which you can do either by doing 12000÷80000 or as 12÷80) gives 0.15, and then multiply it by 68000 gives 10200 Ohms.

Another useful trick is to remember that:

kilo x milli = 1

mega x micro = 1

These are obvious when you realize that, for instance, kilo means 1000 and milli means 0.001; multiply them out and you get 1.

For instance, you want the RC time constant of a 0.001 microfarad capacitor with a 100 K resistor. The textbook says that the RC formula has to have R in Ohms and C in farads, but 0.001 microfarads is 0.000000001 farads, and that's over 8 digits long so you can't enter it. But since mega x micro = 1, convert the 100 K resistor to 0.1 megohm, and use the 0.001 microfarad as is:

$$0.1 \text{ M}\Omega \times 0.001\ \mu\text{F} = 0.001 \text{ second}$$

Another example will bring it out better. You want to know the reactance of a 47 pF capacitor at 6.125 MHz. Well, the standard formula for capacitive reactance is,

$$XC = \frac{1}{2\pi f C}$$

where f is supposed to be in Hertz and C is supposed to be in farads. Great – what do you do with a 0.000000000047 farad capacitor if you only have an 8-digit calculator? Simple – use Megahertz and microfarads:

$$XC = \frac{1}{2 \times 3.1415926 \times 6.125 \times 0.000047}$$

(this is where that $400 calculator would come in useful – just enter it as 47×10^{-12} and you've gotten out of it!) Now you could either multiply out the whole denominator and then find its reciprocal, or an easier way is to take 1, divide by 2, divide by 3.1415926, divide by the 6.125, and finally divide the result by 0.000047, which gives you the answer of 552.85957 Ω.

And now on to the real good stuff – what about square roots? You say you don't need them? Well, what do you do when you want to find the resonant frequency of an LC circuit from the formula:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

How do you find $\sqrt{LC}$? Or you want the voltage across a 50Ω resistor when the power in it is 1 watt – the equation for power is:

$$P = E^2 / R$$

So, $E = \sqrt{PR}$. There must be dozens of electrical equations which require square

roots. You could of course plunk down $$$ for an expensive calculator doing them, but it turns out that a simple procedure can find the square roots even on a simple calculator. To see how it's done, let's try a real simple example – finding the square root of 16.

Not having a square root calculator, we could start out by trying a few guesses. Suppose we try a guess of 3, and check it by squaring 3 x 3 = 9. Nope, 3 was too small a guess. Try 3.5, then 3.5 x 3.5 = 12.25. Nope, still too small, but getting closer, right? Well, we could try 3.8, maybe?

At this rate you might go on a long time before you get there. But suppose we told you that it wasn't such a harebrained scheme – that there was a valid mathematical method that does just this, and that its secret is the presence of a formula that tells you what guesses to try? It's usually buried in obscure textbooks on numerical methods under the name, *Newton-Raphson Iteration*, and it goes like this:

First, take a guess at the square root. Try to take a good guess, but don't worry if you're pretty far off. For the sake of this discussion, we're going to use 3 as a guess for the square root of 16.

Take the 3 and divide it into the 16 on your calculator:

$$\frac{16}{3} = 5.3333333$$

Now look at what you did. Suppose you had taken the right guess (4) and divided it into 16 – the answer would have then been 4, right? A number, divided by its square root is always equal to the square root ($16 \div 4 = 4$, $25 \div 5 = 5$, and so on).

But, of course, we weren't that lucky, since we had a bad guess. Our guess will usually be either too small or too large. In this case 3 was too small a guess. So what happens when we do the division? *The answer comes out too large!* Here 3 is smaller than the real square root, while 5.3333333 is too large. (Had our guess been too *large*, then the quotient would have been too *small*.) Either way, the actual square root is somewhere *between* the guess we take and the quotient we get when we divide that guess into that number. Well, as the next guess, why not try the *average* of these two? We do this by adding the guess to the quotient and then dividing by 2, like this:

$$\text{2nd guess} = \frac{\dfrac{\text{Number}}{\text{1st guess}} + \text{1st guess}}{2}$$

$$\text{3rd guess} = \frac{\dfrac{\text{Number}}{\text{2nd guess}} + \text{2nd guess}}{2}$$

$$\text{4th guess} = \frac{\dfrac{\text{Number}}{\text{3rd guess}} + \text{3rd guess}}{2}$$

It turns out that, no matter how bad our first guess is, the second is always more accurate, the third is even better, and so on. If the original guess is pretty close, then as few as two or three repetitions of this formula will give you the right answer within the accuracy of your calculator. Usually, out of the first 8 digits on the calculator, the first 7 will be correct and the last one may be slightly off, but even this is within something like 0.0001%, and that's close enough.

For instance, let's complete our example above: 16 divided by 3 is 5.3333333, so:

$$\frac{\frac{16}{3} + 3}{2} = \frac{5.3333333 + 3}{2} = \frac{8.3333333}{2} = 4.166666$$

Notice that this is a lot closer to 4 than the original guess was. Repeat it again:

$$\frac{\dfrac{16}{4.1666666} + 4.1666666}{2} = 4.0033333$$

and again:

$$\frac{\dfrac{16}{4.0033333} + 4.0033333}{2} = 4.0000013$$

and again:

$$\frac{\frac{16}{4.0000013} + 4.0000013}{2} = 4.0000000$$

And there you are – the right answer after four repetitions. Actually, the entire repetition of the formula can be done in a few seconds, so it is quite an easy process when you get the hang of it. How do you know when to stop? Simple – when the numbers start to repeat themselves.

Just to show you how easy it is, let's try it again, this time to find the square root of 10. Try 3.2 as the first guess:

$$\frac{\frac{10}{3.2} + 3.2}{2} = 3.1625$$

$$\frac{\frac{10}{3.1625} + 3.1625}{2} = 3.1622776$$

$$\frac{\frac{10}{3.1622776} + 3.1622776}{2} = 3.1622776$$

You are starting to repeat yourself, so it's time to stop. The actual square root is a bit closer to 3.1622777, but we are as close as we can get on an 8-digit calculator.

In this case it took us only three tries to get the answer – in general, the closer your first guess, the faster you'll get to the answer. But if your first guess is real bad, it doesn't mean that your answer will be any less accurate – it only takes a little longer to get it.

On very large or very small numbers it may be a little hard to get a good first guess. The trick here is to break up the number into groups of two digits, starting from the decimal point, and have one digit in the guess for each group of two digits in the original number.

For instance, for the square root of 16,777,216, break it up into groups of two digits like 16 77 72 16. Since there are four groups of two digits, the guess should have four digits in it. But even better, since the square root of the first group (16) is about 4, make the first digit of the guess a 4. Hence, a good guess would be 4000 or a little more (the actual square root of 16,777216 is 4096).

As another example, for the square root of 0.00000007, break it up as 0. 00 00 00 07 and, since the square root of 07 is somewhere around 3, use 0.0003 as a guess.

This last example shows another problem – 0.00000007 is too long for an 8-digit calculator. The best way to find its square root is to break it up into two parts, perhaps something like:

0.00000007 = 0.07 x 0.000001

Find the square root of each part separately, and then multiply out the square roots. The square root of 0.07 here is .2645751, while the square root of 0.000001 is 0.001; multiply the two out and you get 0.0002645751 as the square root. Finding the square root of 0.000001 is really easy if you know scientific notation, since 0.000001 is 10^{-6}, and the square root of that is automatically found to be 10^{-3} but that's another subject.

As our last set of tricks, we will describe some formulas you can use if you want to find things like sines, cosines, tangents and exponentials (powers of e). You could, of course, look these up in a table, or else get the $300 or $400 calculator, but if you use the following formulas you will get answers almost as accurate. Obviously, if you don't know what these are, then you probably don't need them. But if you do, they might be handy. By the way, if you would like to look up the derivations of these, they may be found in most textbooks on numerical methods (such as reference 1) under Maclaurin series, using Horner's rule, with angles converted from radians to degrees. So here goes: for the sine and cosine, with an angle X in degrees (only angles between 0° and 90° will work accurately; for other angles you will have to convert to an angle between 0° and 90°), use the following formulas:

$$\sin X = \frac{X}{57.295779}\left\{1 - \frac{X^2}{19696.837}\left[1 - \frac{X^2}{65656.124}\left(1 - \frac{X^2}{137877.86}\right)\right]\right\}$$

CALCULATING THE SINE OF 30 DEGREES

DO THIS (STARTING FROM THE TOP)	BY PUSHING	AND DISPLAY SHOWS
Clear the machine	C	0.
Enter 30 degrees	30	30.
square it	x=	900.
and divide it	÷	900.
by 137877.86	137877.86	137877.86
and make it negative	=–	–0.0065275
Now add 1	1+	0.9934725
Multiply by 30	x	0.9934725
Multiply by 30	30	30.
and again by 30	x	29.804175
and again by 30	30	30.
and divide it	÷	894.12525
by 65656.124	65656.124	65656.124
and make it negative	=–	–0.0136183
Now add 1	1+	0.9863817
Multiply by 30	x	0.9863817
Multiply by 30	30	30.
and again by 30	x	29.591451
and again by 30	30	30.
and divide it	÷	887.74353
by 19696.837	19696.837	19696.837
and make it negative	=–	–0.0450703
Now add 1	1+	0.9549297
Multiply by 30	x	0.9549297
Multiply by 30	30	30.
and divide it	÷	28.647891
by 57.295779	57.295779	57.295779
and get the final answer by pushing =		0.5

$$\cos X = 1 - \frac{X^2}{6565.6124}\left[1 - \frac{X^2}{39393.672}\left(1 - \frac{X^2}{98484.18}\right)\right]$$

CALCULATING THE COSINE OF 60 DEGREES

DO THIS (STARTING FROM THE TOP)	BY PUSHING	AND DISPLAY SHOWS
Clear the machine	C	0.
Enter 60 degrees	60	60.
square it	x=	3600.
and divide it	÷	3600.
by 98484.18	98484.18	98484.18
and make it negative	=–	–0.036554
Now add 1	1+	0.963446
Multiply by 60	x	0.963446
multiply by 60	60	60.
and again by 60	x	57.80676
and again by 60	60	60.
and divide it	÷	3468.4056
by 39393.672	39393.672	39393.672
and make it negative	=–	–0.0880447
Now add 1	1+	0.9119553
multiply by 60	x	0.9119553
multiply by 60	60	60.
and again by 60	x	54.717318
and again by 60	60	60.
and divide it	÷	3283.039
by 6565.6124	6565.6124	6565.6124
and make it negative	=–	–0.5000354
and finally add 1	1+	0.4999646

Both of these formulas can be done in one long series of calculations without writing down any intermediate answers, but starting from the right and working to the left. For example: To get the sine of 30° (the exact answer is .5000000), or to get the cosine of 60° (also an exact answer of .5000000) we proceed as in the Table. Each of these formulas is very accurate for small angles, and becomes slightly worse at large angles. To find the tangent of an angle, find both the sine and the cosine and then divide the sine by the cosine.

To find the values of of e^X (exponentials) for values of x less than 1, and with an accuracy of about 0.1%, use the following formula:

$$e^X = 1 + X\left\{1 + \frac{X}{2}\left[1 + \frac{X}{3}\left[1 + \frac{X}{4}\left(1 + \frac{X}{5}\left(1 + \frac{X}{6}\right)\right)\right]\right]\right\}$$

As before, we start from the right and go toward the left, in the sequence: Take X, divide by 6, add 1, multiply by X, divide by 5, add 1, etc. As before, we get better accuracv when X is quite a lot less than 1. In case you want to try your luck on your calculator, the value of e (calculated from the above formula by letting X equal 1) is supposed to be 2.7180555; not bad.

Conclusion

If we haven't confused you completely by now, then consider yourself lucky. The moral of the story is that even an expensive calculator won't do your thinking for you, but if you know how to juggle numbers then it can really make your life easier. Hopefully, the above information will help you make a little better use out of your unit and you will soon find, as we have, that these little critters are more fun than a barrel of monkeys. If, on some rainy afternoon, you have nothing better to do, why don't you try to find the square root of *your* telephone number?

. . .K2OAW

REFERENCE:

(1) Introduction to Numerical Methods by Peter A. Stark, MacMillian Co., 1970. Make the author real happy by going right out and buying a couple of copies!

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OPTIMUM CW FILTER DESIGN

There have been dozens of papers written on desigrn and construction of CW audio filters. This type of filter can allow a marginal receiver to perform acceptably and a fine receiver can be further improved. Today's crowded bands makes a selective receiver system mandatory. The published articles vary from passive filters to complex active filters, with center frequencies from 200 Hz to 1020 Hz, and with bandwidths from 30 Hz to 600 Hz. The object of this article is to present sufficient design criteria and experimental data to allow the perspective builder of a CW audio filter to guide his design towards a filter that is optimum for his particular operating needs. This is not a construction article and the design criteria apply equally well to passive and active filters.

Fig. 1 shows a normalized plot of a bandpass filter, typical of the type used in CW filters. The bandwidth, or selectivity, for this type of filter is usually specified at the −6 dB point. From the curves of Fig. 1, it can be seen that the normalized bandwidth is determined by the Q of the filter. This relationship is:

$$Q = f_o/\Delta f = \frac{\text{Resonance Frequency}}{\text{-6 dB Bandwidth}}$$

Since amateur operators are primarily interested in an absolute filter bandwidth in

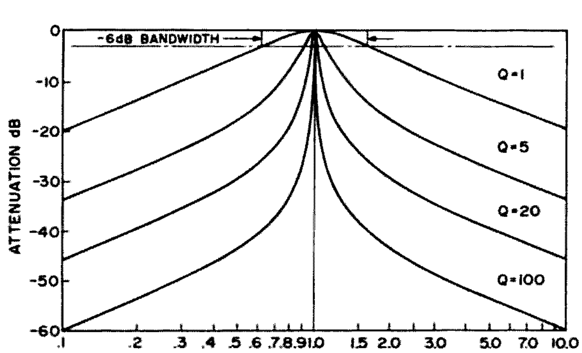
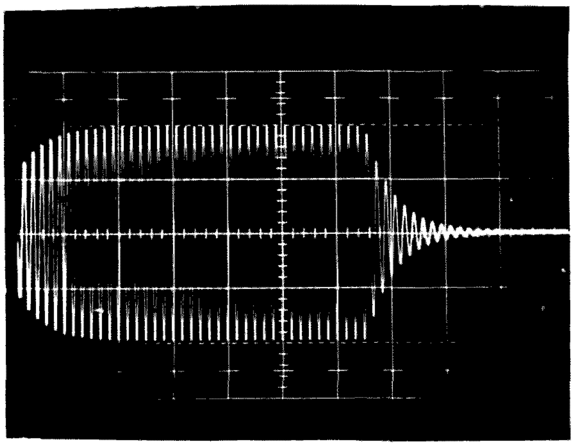
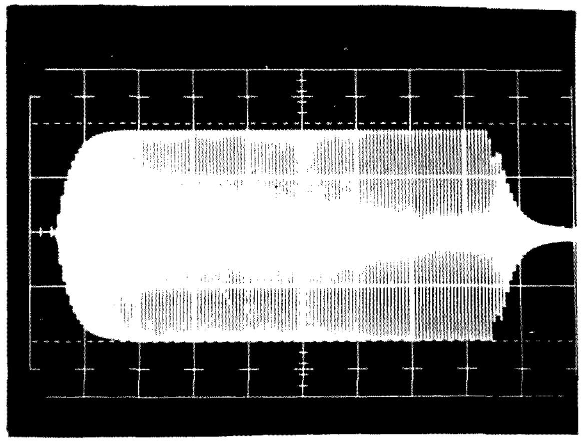


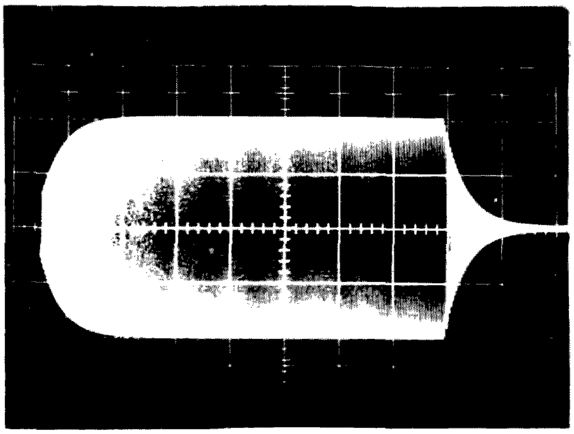
Fig. 1. Band-pass transfer characteristics normalized for unity gain and frequency.



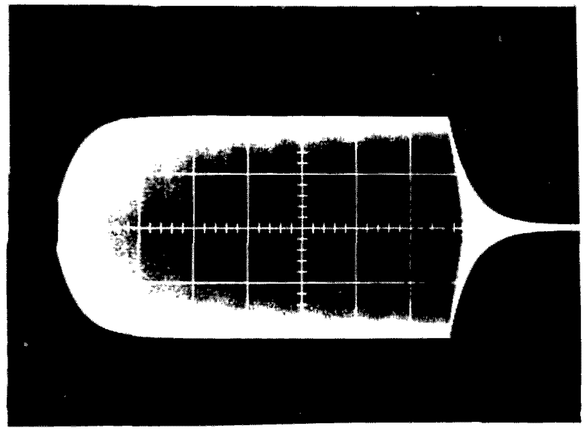
a. Fo = 300 Hz



b. Fo = 800 Hz



c. Fo = 1500 Hz



d. Fo = 2000 Hz

Fig. 2. Keyed waveform of CW filters with 50Hz bandwidth and center frequencies of 300, 800, 1500 and 2000 Hz. (Horiz. = 20 msec/cm).

Hz rather than a normalized bandwidth, it's apparent that, for a fixed Q, the absolute bandwidth will decrease in direct proportion to the resonant frequency of the filter.

An experimental investigation was made to determine the effects, if any, of variations of center frequency while maintaining a constant filter bandwidth of 50 Hz. This data is shown in Fig. 2a, b, c, d. These figures show the shape of a keyed waveform after passing through the filter. It's interesting to note that the rise and fall times (rise time is the time required for the filtered waveform to go from 10% to 90% of its full value) of the waveform are the same, regardless of the center frequency. This indicates that for a fixed filter bandwidth, the performance is independent of center frequency, even though the Q of the filter ranged from 4 at 200 Hz to 20 at 1,000 Hz.

Lubkin(2)has shown that the rise time, or fall time of a filter, subjected to a pulse input is approximately:

$$\text{Rise Time} = \Delta t = \frac{.342 \text{ to } .570}{1/2 \times (-6 \text{ dB Bandwidth})}$$

For the data of Fig. 2, this equation predicts a rise time from 13.7 to 22.8 millisecs, which is close to that shown in Fig. 2.

Since rise time is intimately realted to the bandwidth of the filter, it can slso effect the intelligibility of the transmitted information. If the rise time is long compared to the length of a transmitted pulse, dot or dash, the signal will sound distorted and could be difficult to copy. The rise time should not be longer than the time required for the shortest pulse; an acceptable criteria is a rise time equal to 1/2 the length of the shortest pulse.

The Morse Code, being a series of dots, dashes and spaces, looks much like a square wave. This square wave can be represented by the sum of a series of sine waves; a Fourier series. This Fourier series will contain the odd harmonics of the fundamental frequency. Including the first through the seventh harmonic in this series gives a good representation of a square shaped wave. For Morse Code, represented by a Fourier series with the seventh harmonic and the 2 samples per cycle required by Shannon's criteria, the lowest audio frequency that can be used to receive code is 14 times the frequency corresponding to the dot period. The frequency of the Morse Code square wave is a function of the code speed with the dot period determining the frequency (the space between dots is equal to a dot, dashes are 3 dots, spaces between letters, 2 dots, etc.). The CW signal is received as an interupted audio frequency sine wave, with the square wave code pattern being the amplitude envelope of this sine wave.

This representation of a square wave by a sine wave is essentially a sampling technique and Shannon's Law states that it takes a minimum of 2 samples per cycle of the highest frequency persent to convey enough information to be able to reconstruct the original wave form.

The average letter of the alphabet, numbers, and punctuation, has an equivalent length of 11.3 dot periods (2 dot periods make one square wave cycle). For average 5 letter words the frequency of the dot period is a function of code speed.

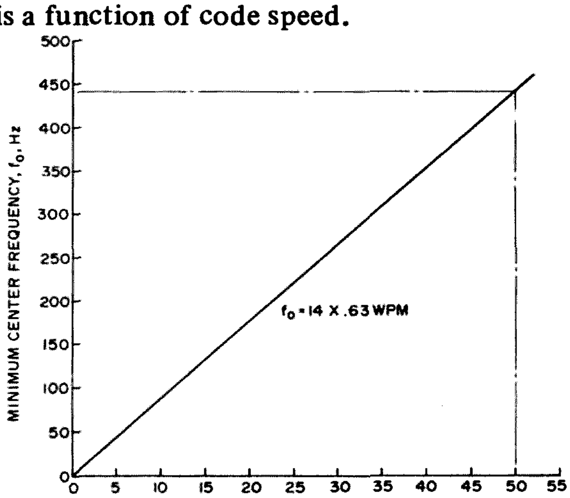


Fig. 3. Minimum center frequency required to accurately reproduce a keyed waveform; Morse Code wpm.

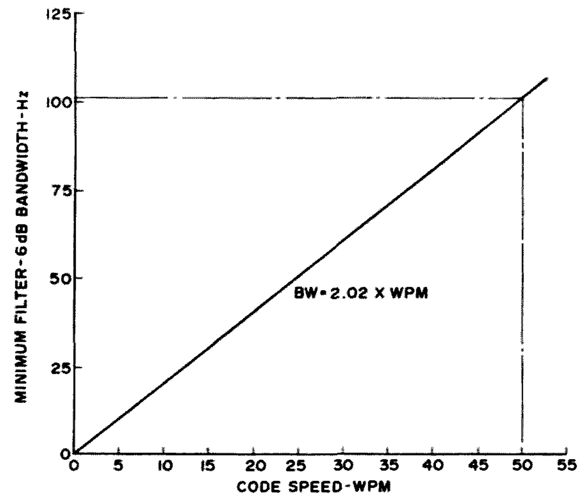


Fig. 4. Minimum allowable -6dB filter bandwidth to acceptably pass a keyed waveform vs. code speed.

Dot Frequency = f_d

$$= \frac{\Delta wpm}{60} \quad \underset{\text{Letters}}{\frac{5\,(11.3)}{2}} + \underset{\text{Space Between Letters}}{\frac{12}{2}} + \underset{\text{Space Between Words}}{\frac{7}{2}}$$

$$f_d = \frac{wpm\,(37.5)}{60} = .63 \text{ wpm}$$

For 25 WPM, $f_d = 15.8$ Hz, therefore the minimum frequency required to reconstruct a Morse Code wave form is:

$f_o = 14 \times f_d$ or 221 Hz for 25 wpm

This equation is plotted as minimum center frequency vs. Code speed in Fig. 3.

Now that we nave an expression for the frequency of the Morse Code as a function of code speed, we can now relate the rise time and filter bandwidth to code speed. The criteria suggested is to set the rise time to be less than 1/2 of the dot time.

Dot Frequency = $f_d = .63 \times$ wpm

$$\text{Dot Period} = \frac{1}{2 f_d} = \frac{1}{1.26 \times \text{wpm}}$$

$$\text{Max Rise Time} = \frac{.40}{1/2 \times (-6\text{db B.W.})}$$

$$\text{Rise Time} = \frac{.40}{(-6\text{db Bandwidth}) \times 1/2}$$

$$= \frac{1}{2\,(\text{dot period})} = \frac{1}{2} \times \frac{1}{1.26 \times \text{wpm}}$$

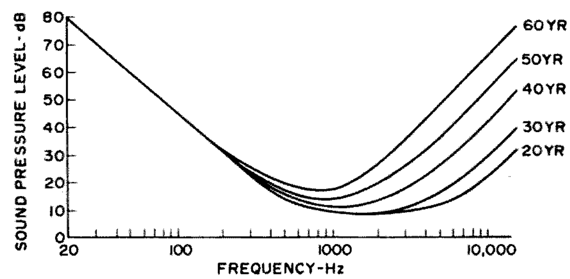


Fig. 5. Threshold of audibility of the ear as a function of frequency and age of listener.

Minimum BW = 2.02 x WPM which is a bandwidth of 20 Hz at 10 WPM and 50 Hz at 25 WPM. This data is plotted in Fig. 4.

Beranek 4 has shown that the human ear acts as a bandpass filter to incoming sounds (see Fig. 5). Since this natural filter must be inserted after an audio filter,, the net filter response will be the result of these two filters in a series. To obtain the best overall filter response one should choose a center frequency for the CW audio filter that corresponds to peak sensitivity of the ear, i.e., approximately 700 Hz for a middle aged ham.

Summary

It has been shown, for a CW audio filter, that there is a minimum center frequency and bandwidth required to pass a keyed waveform that is representative of the input Morse Code and that these minimum values increase with increasing code speed. It was also shown, for fixed Q components, that a low center frequency will yield a narrow bandwidth filter. The optimum center frequency was determined by matching it to the peak response of the ear. I hope that this article will aid CW filter designers to design and construct filters that are well matched to their operating needs.

. . .W6AGX

References

(1) Reference Data for Radio Engineer, H.W. Sams & Co., Ind., Ind., 1968

(2) Lubkin, Y.I., "More on Maximally Flat Dealy Networks", Electronic Design, Pp 101, 102, 11 May 1964

(3) Shannon, C.E., "Communication in the Presence of Noise", Proc. I.R.E., Vol. 37, No. 1, Pp 10–21, Jan. 1949

(4) Beranek, L.L. "Acoustics", McGraw Hill New York, 1954

FCC RULES AND REGULATIONS, PART 97 (VII)

Continuing from last month the complete text of the FCC Rules and Regulations pertaining to the Amateur Radio Service.

Subpart E—Prohibited Practices and Administrative Sanctions

PROHIBITED TRANSMISSIONS AND PRACTICES

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SUBPART E—PROHIBITED PRACTICES AND ADMINISTRATIVE SANCTIONS

PROHIBITED TRANSMISSIONS AND PRACTICES

§ 97.112 No remuneration for use of station.

An amateur station shall not be used to transmit or receive messages for hire, nor for communication for material compensation, direct or indirect, paid or promised.

[*Former § 97.111 redes. as § 97.112 eff. 10-17-72; VI (72)-1*]

§ 97.113 Broadcasting prohibited.

Subject to the provisions of § 97.91, an amateur station shall not be used to engage in any form of broadcasting, that is, the dissemination of radio communications intended to be received by the public directly or by the intermediary of relay stations, nor for the retransmission by automatic means of programs or signals emanating from any class of station other than amateur. The foregoing provisions shall not be construed to prohibit amateur operators from giving their consent to the rebroadcast by broadcast stations of the transmissions of their amateur stations, provided, that the transmissions of the amateur stations shall not contain any direct or indirect reference to the rebroadcast.

§ 97.114 Third party traffic.

The transmission or delivery of the following amateur radiocommunication is prohibited:

(a) International third party traffic except with countries which have assented thereto;

(b) Third party traffic involving material compensation, either tangible or intangible, direct or indirect, to a third party, a station licensee, a control operator, or any other person.

(c) Except for an emergency communication as defined in this part, third party traffic consisting of business communications on behalf of any party. For the purpose of this section business communication shall mean any transmission or communication the purpose of which is to facilitate the regular business or commercial affairs of any party.

[*§ 97.114 added eff. 12-1-72; VI (72)-1*]

§ 97.115 Music prohibited.

The transmission of music by an amateur station is forbidden.

§ 97.116 Amateur radiocommunication for unlawful purposes prohibited.

The transmission of radiocommunication or messages by an amateur radio station for any purpose, or in connection with any activity, which is contrary to Federal, State, or local law is prohibited.

[*§ 97.116 added eff. 12-1-72; VI (72)-1*]

§ 97.117 Codes and ciphers prohibited.

The transmission by radio of messages in codes or ciphers in domestic and international communications to or between amateur stations is prohibited. All com-

munications regardless of type of emission employed shall be in plain language except that generally recognized abbreviations established by regulation or custom and usage are permissible as are any other abbreviations or signals where the intent is not to obscure the meaning but only to facilitate communications.

§ 97.119 Obscenity, indecency, profanity.

No licensed radio operator or other person shall transmit communications containing obscene, indecent, or profane words, language, or meaning.

§ 97.121 False signals.

No licensed radio operator shall transmit false or deceptive signals or communications by radio, or any call letter or signal which has not been assigned by proper authority to the radio station he is operating.

§ 97.123 Unidentified communications.

No licensed radio operator shall transmit unidentified radio communications or signals.

§ 97.125 Interference.

No licensed radio operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal.

§ 97.127 Damage to apparatus.

No licensed radio operator shall willfully damage, or cause or permit to be damaged, any radio apparatus or installation in any licensed radio station.

§ 97.129 Fraudulent licenses.

No licensed radio operator or other person shall obtain or attempt to obtain, or assist another to obtain or attempt to obtain, an operator license by fraudulent means.

ADMINISTRATIVE SANCTIONS

§ 97.131 Restricted operation.

(a) If the operation of an amateur station causes general interference to the reception of transmissions from stations operating in the domestic broadcast service when receivers of good engineering design including adequate selectivity characteristics are used to receive such transmissions and this fact is made known to the amateur station licensee, the amateur station shall not be operated during the hours from 8 p.m. to 10:30 p.m., local time, and on Sunday for the additional period from 10:30 a.m. until 1 p.m., local time, upon the frequency or frequencies used when the interference is created.

(b) In general, such steps as may be necessary to minimize interference to stations operating in other services may be required after investigation by the Commission.

§ 97.133 Second notice of same violation.

In every case where an amateur station licensee is cited within a period of 12 consecutive months for the second violation of the provisions of §§ 97.61, 97.63, 97.65, 97.71, or 97.73, the station licensee, if directed to do so by the Commission, shall not operate the station and shall not permit it to be operated from 6 p.m. to 10:30 p.m., local time, until written notice has been received authorizing the resumption of full-time operation. This notice will not be issued until the licensee has reported on the results of tests which he has conducted with at least two other amateur stations at hours other than 6 p.m. to 10:30 p.m., local time. Such tests are to be made for the specific purpose of aiding the licensee in determining whether the emissions of the station are in accordance with the Commission's rules. The licensee shall report to the Commission the observations made by the cooperating amateur licensees in relation to the reported violations. This report shall include a statement as to the corrective measures taken to insure compliance with the rules.

§ 97.135 Third notice of same violation.

In every case where an amateur station licensee is cited within a period of 12 consecutive months for the third violation of §§ 97.61, 97.63, 97.65, 97.71, or 97.73, the station licensee if directed by the Commission, shall not operate the station and shall not permit it to be operated from 8 a.m. to 12 midnight, local time, except for the purposes of transmitting a prearranged test to be observed by a monitoring station of the Commission to be designated in each particular case. The station shall not be permitted to resume operation during these hours until the licensee is authorized by the Commission, following the test, to resume full-time operation. The results of the test and the licensee's record shall be considered in determining the advisability of suspending the operator license or revoking the station license, or both.

§ 97.137 Answers to notices of violations.

Any licensee receiving official notice of a violation of the terms of the Communications Act of 1934, as amended, any legislative act, Executive order, treaty to which the United States is a party, or the rules and regulations of the Federal Communications Commission, shall, within 10 days from such receipt, send a written answer direct to the office of the Commission originating the official notice: *Provided, however,* That if an answer cannot be sent or an acknowledgment made within such 10-day period by reason of illness or other unavoidable circumstances, acknowledgment and answer shall be made at the earliest practicable date with a satisfactory explanation of the delay. The answer to each notice shall be complete in itself and shall not be abbreviated by reference to other communications or answers to other notices. If the notice relates to some violation that may be due to the physical or electrical characteristics of transmitting apparatus, the answer shall state fully what steps, if any, are taken to prevent future violations, and if any new apparatus is to be installed, the date such apparatus was ordered, the name of the manufacturer, and promised date of delivery. If the notice of violation relates to some lack of attention or improper operation of the transmitter, the name of the operator in charge shall be given.

SUBPART F—RADIO AMATEUR CIVIL EMERGENCY SERVICE (RACES)

GENERAL

§ 97.161 Nature of this service.

(a) The Radio Amateur Civil Emergency Service provides for amateur radio operation for civil defense communications purposes only, during periods of local, regional or national civil emergencies, including any emergency which may necessitate invoking of the President's War Emergency Powers under the provisions of Section 606 of the Communications Act of 1934, as amended.

(b) Pursuant to the provisions of section 4(j) of the Communications Act of 1934, as amended, records relating to the Radio Amateur Civil Emergency Service shall not be open to general public inspection.

§ 97.163 Definitions.

For the purposes of this subpart, the following definitions are applicable:

(a) *Radio Amateur Civil Emergency Service.* A radiocommunication service carried on by licensed amateur radio stations while operating on specifically designated segments of the regularly allocated amateur frequency bands under the direction of authorized local, regional or federal civil defense officials pursuant to an approved civil defense communications plan.

(b) *Radio Amateur Civil Emergency Station.* An amateur radio station which is authorized to operate in the Radio Amateur Civil Emergency Service for the purpose of transmitting and receiving civil defense communications.

(c) *Civil defense communications.* Communications or signals essential to the conduct of civil defense activities of duly authorized civil defense organizations, including communications directly concerning safety of life, preservation of property, maintenance of law and order, alleviation of human suffering and need and dissemination of warnings of enemy attack to the civilian population in case of actual or impending armed attack or in any disaster or other incident endangering the public welfare. Such communications may also include transmissions necessary to establishment and maintenance of the radio system and communications essential to the training of civil defense personnel.

(d) *Civil defense authority.* The legally appointed Director of Civil Defense, or his authorized alternate or representative, for the particular geographical area (city, county, etc.) which a proposed radio station is intended to serve, and who is responsible to local governmental authority for protection and aid to the civilian population in the event of armed attack or of any disaster or other incident endangering public safety.

(e) *Civil Defense Communications Officer.* The official of any duly constituted civil defense organization having direct responsibility under the Director of that organization for the provision, organization, maintenance, readiness, and utilization of all means of communication to be used by such civil defense organization in the performance of its lawful functions.

(f) *Civil Defense Radio Officer.* The duly designated official of a legally constituted civil defense organization who is directly responsible either to the Communications Officer or to the Director of such civil defense organization for the provision, organization, maintenance, readiness, and utilization of radio communications facilities for civil defense use.

(g) *Radio Amateur Civil Emergency Network.* All radio amateur civil emergency stations intended to be included in the civil defense communications plan of the area concerned and which operate, or are to operate, in conjunction with a single control station. Such network may be made up of several separately authorized radio amateur civil emergency stations or units of such stations, or may be made up of several units of the same station operated at different locations. In addition, the same radio amateur civil emergency station or any unit of such station may be a part of more than one network; e.g., the control station of one network may also be the control station or a member station of another network operated in conjunction therewith.

§ 97.185 Single application for all equipment under one amateur station license.

Only one application need be filed for any one amateur station, including all transmitting equipment under the control of the licensee of that station, even though individual units of such station are capable of being operated and are intended to be operated independently at different locations, or as portable or mobile stations with no fixed locations. No distinction need be made between those units which are personally owned by the amateur station licensee and those units which are otherwise under his technical control for operation in this service.

§ 97.187 Issuance of station authorization.

An authorization to operate in this service will be issued in the discretion of the Commission upon satisfactory completion of all requirements of this subpart and proper certification that the requirements of the civil defense organization for which the station will be used have been or are being complied with. The station authorization (Form 481–3) will be forwarded to the Civil Defense Radio Officer for delivery to the applicant. Such authorization will be accompanied by a stub (Form 481–2) which may be retained by the civil defense radio officer for his records.

§ 97.189 Term of station authorization.

(a) Authorization to operate an amateur station in the Radio Amateur Civil Emergency Service will be issued for a term running concurrently with the term of the amateur radio station license. Application for renewal of such authorization shall be filed concurrently with application for renewal of the basic amateur radio station license.

(b) Whenever, under rules contained in Subparts A through E of this part, modification of the basic amateur station license becomes necessary, if such modification affects the information submitted with the original application for authorization in the Radio Amateur Civil Emergency Service, application for modification of the Radio Amateur Civil Emergency service station authorization shall be submitted concurrently therewith.

(c) Nothing in this section shall be construed to alter the Commission's authority to cancel or amend a station authorization in the Radio Amateur Civil Emergency Service in accordance with the applicant's agreement as indicated on the initial application for station authorization.

§ 97.191 Cancellation of station authorization.

(a) Each authorization for operation in the Radio Amateur Civil Emergency Service shall be issued with the express provision that such authorization is subject to revocation or cancellation without hearing whenever, in the opinion of the Commission, the security of the United States or the proper functioning of the Radio Amateur Civil Emergency Service would be served thereby.

(b) The station authorization shall be submitted to the Commission (via the Civil Defense Radio Officer) for cancellation under the following circumstances:

(1) The station for which the authorization was issued becomes inactive for a period of three months or it is not planned to use the station in the radio amateur civil emergency network for a period of at least three months.

(2) The basic amateur radio station license of the station has expired and has not been renewed.

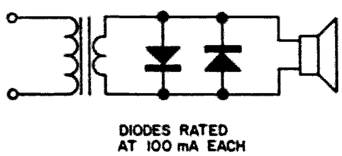
(3) In cases where the amateur radio station license and the radio amateur civil emergency station authorization have both been modified, the original authorization of the latter shall be submitted to the Commission immediately upon receipt by the licensee of a new or modified authorization.

(To be continued next month)

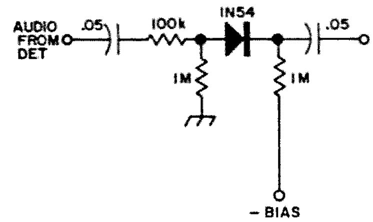
CIRCUITS, CIRCUITS, CIRCUITS. .

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

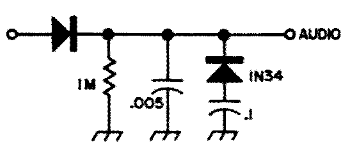
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



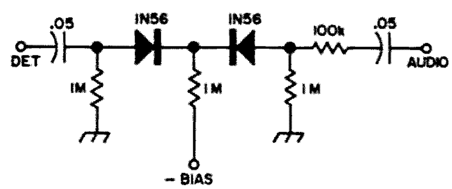
Shunt diode noise limiter for use across a loudspeaker.



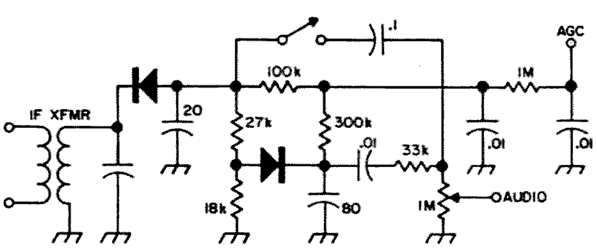
Half-wave series noise limiter with adjustable clipping level .



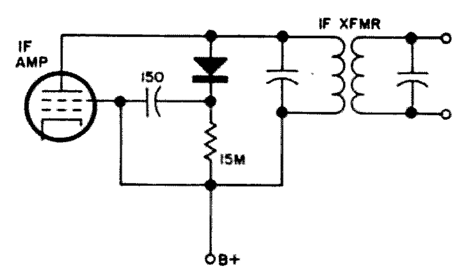
Shunt diode noise limiter that can be easily added to the input of an audio amplifier .



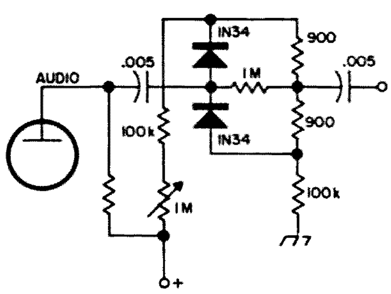
Full-wave series noise limiter .



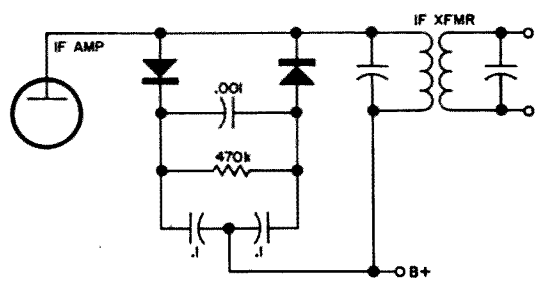
One of the best noise limiters is the "rate-of-change" limiter designed for TV audio in England.



This simple noise limiter is installed in an i-f stage for SSB and CW use. The diode must have high back resistance, low capacitance and short rise time.



This "trough" limiter will eliminate the background noise that is ignored by conventional limiters.



This is an improved version of the SSB i-f noise limiter above.

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Digital ID unit–K1OZS 39 Jul
Repeater maps–USDI 50 Jul
85 dB gain ant–K1TKJ 71 Jul
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Talk power and FM-W2EUP 79 Aug
Rptr logic system–WA1OMS 27 Sep
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The patch pad–K4MOG 51 Sep
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One IC 2m front end–K1CLL 21 Oct
Europe's DX rptr–W2EEY 49 Oct
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Heath GR-110 scanner–W3WTO 39 Nov
Legal autopatch–W3YVV 49 Nov
12Vdc supply for FM–WA3EEC/1 63 Nov
1watt HT-100–K6VGP 77 Nov
2 tone decoder–W3JJU 81 Dec

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The Greenie–K1YSD 63 Dec

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Hal ID-1 mods–W3GHZ/Ø 126 Jan
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Digital ID unit–K1OZS 39 Jul
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Using auto ID–K6HKB/1 91 Dec

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Phase locked loops–W9KXJ 47 Sep
Neon bulb osc –Weinstein 67 Oct
Comp. pair audio amp–W5SOT 93 Nov

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Transformer cooling–WAØABI 121 Jan
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Perfect summer job–WA8MLG 75 Jun
Tape recorder replay–W6FPO 29 Oct
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Total mobile alarm–WA4SAM 19 May
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Roof mounted whips–WB6HYD 39 May
Voltage limit sensor–W4UXJ 53 May
Mobile audio boost–W2EEY 81 May
Simple auto alarm–WA1KON 97 May
Mobile DXing–K4TWJ 53 Jul
Digital "Hi" gen–WA6JMM 61 Oct

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IC protection–W4ATE 142 Feb
Updating nobatrons–W6GXN 77 Mar
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12Vdc supply for FM–WA3EEC/1 63 Nov
Pwr failure prot.–Ives 73 Nov
Simple regulator–KL7EVO 87 Dec

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Tunable audio filter–G8ABR 85 Jan
IC 10m tuner for VHF–K1CLL 99 Jan
Improving Drake R4A–VE6TW 112 Jan
Diode noise limiter–EI4R 113 Jan
Improved AGC system–ZL2BDB 115 Jan
2m FM converter–WB6CDU 80 Feb
Add filters to 75A4– WØIQI 105 Feb
Taming FETs on 2m–K1CLL 27 Apr
Tuneable L.O. for 2m FM–K1CLL 21 Jul
2m alignment aid–K1CLL 43 Sep
S-meter for HW-7–WA6QYU 53 Sep
2m converter–WBBBIH 65 Sep
One IC 2m front end–K1CLL 21 Oct
Heath GR-110 scanner–W3WTO 39 Nov
Peak/notch filter–W6AGX 69 Nov
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6+2m surplus power–K4EPI 31 Mar
RCA CMU 15, 450 MHz–WB6BIH 79 Apr
T-44 ATV system–WBØFQF 29 Jul
2m GE pocket mate–WB4DBB 13 Oct

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SSTV circuits, I–W9NTP 63 Feb
Receive SSTV as FAX–W6WMI 20 Mar
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Another freq. counter–KL7GGB/4 39 Jan
Freq meas system, II–K5DUS 49 Feb
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19 IC digital clock–WA6QVQ 55 Mar
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Calibrated FSM–VE3CES 85 Jun
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VOM design–WA3JBN 63 Aug
Photocell wattmeter–K5CXN 39 Oct
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450 MHz, getting started–K1CLL 21 Nov
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Code speed display–VE1BU/W3 25 Dec
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Sunspots & future DX–VE3CEA 60 Jan
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Understanding FETs–K9VMH 86 Feb
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Capacity measurement–W3HTF 108 Feb
Time–WB6KFI 125 Feb
Deviation meters–VE7ABK 81 Mar
Bandpass filter design–WB6NWQ 101 Mar
Transistor RF amps, II–W9EGQ 93 Apr
Oscar 6 inv Doppler–WØMJS, WØLER 57 Sep
Potentiometers–Centore 77 Sep
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CW Filter Design–W6AGX 107 Dec

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HT-touch tone–W1ODI 31 Jan
The burst box–WA7NMO 25 May
The patch pad–K4MOG 51 Sep
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Six band KW linear–WA9JMY 89 Jan
Transistor RF amps, I–W9EGQ 97 Feb
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Gonset 201 mods–W6HGX 118 Feb
6&2 surplus power–K4EPI 31 Mar
Compact linear–K9PVY 50 Mar
1 and 6w 2m amplifiers–WB4DBB 31 Apr
Transistor RF amps, II–W9EGQ 93 Apr
ISC FM xmtr mod–WB6QAM 109 Apr
1w 2m FM xmtr–WB6BIH 65 May
6m 5w amplifier–K1CLL 83 May
QRP on 180 kHz?–W5SOT 93 May
220 signal generator–K1CLL 23 Jun
Hybrid 40m xmtr–WB6BIH 55 Jun
VHF pwr amp design–K6RAO 31 Aug
Amateur's intercom–K1CLL 39 Aug
QRP transmitter–WB6BIH 65 Aug
450 MHz exciter–K1CLL 71 Aug
2kw building block–W2EEY 31 Oct
Freq. mult w/xstrs–K1CLL 69 Oct
2m linear amp–W4KAE 29 Dec
Microphone preamp–WA6QJU 71 Dec

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450 MHz preamp–WB6BIH 33 May
UHF output meter–K2EE 37 Jun
T-44 ATV system–WBØFQF 29 Jul
450 MHz power divider–WA3AXV 57 Jul
450 MHz exciter–K1CLL 71 Aug
Measuring microwaves–WA9VFG 17 Oct
450 MHz, getting started–K1CLL 21 Nov
ATV, getting started–WA7NMO 26 Nov

VHF
(Also See FM)

6m converter– K1CLL 79 Jan
IC 10m tuner for VHF–K1CLL 99 Jan
6&2 surplus power–K4EPI 35 Mar
Taming FETs on 2m–K1CLL 27 Apr
1 and 6w 2m amplifiers–WB4DBB 31 Apr
6m 5w amplifier–K1CLL 83 May
220 signal generator–K1CLL 23 Jun
VHF pwr amp design–K6RAD 31 Aug
2m converter–WB6BIH 65 Sep
One IC 2m front end–K1CLL 21 Oct
Freq. mult. w/xstrs–K1CLL 69 Oct
2m linear amp–W4KAE 29 Dec
Portable 2m beam–W1BHD 89 Dec

VISITS

Visit to Yaesu– WB6IZF 37 Jan
73 visits Jordan–W2NSD 12 Sep
73 visits Sentry–W2NSD 81 Sep

PROPAGATION CHART

J.H. Nelson

Good (Open) Fair (□) Poor (O)

December 1973

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Possible aurora 19, 20.

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ARGENTINA	14	7	7	7	7	7	14	21	21	21	21	14
AUSTRALIA	14	7B	7B	7B	7	7	7B	7A	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	14	14A	21	21	21	14
ENGLAND	7	7	7	3	7	7B	14	21	21	14	7B	7
HAWAII	14	7B	7	7	7	7	7	7B	7A	21	21A	21
INDIA	7	7	7B	7B	7B	7B	7A	14	7B	7B	7	7
JAPAN	14	70	7B	7	7	7	3A	7	7B	7B	7B	14
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SOUTH AFRICA	7	7	7	7	7	7B	14	21	21A	21	14	14
U.S.S.R.	7	7	3A	3A	7	7B	14	14A	14	7B	7	7
WEST COAST	14	7	7	7	7	7	7	14	21	21A	21A	14

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
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ARGENTINA	14	7A	7	7	7	7	7	14	21	21	21	21
AUSTRALIA	14A	14	7B	7B	7	7	7B	7	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	3	7	7	7B	14	14	14	7B	7
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PHILIPPINES	14	7B	7B	7B	7B	7	3A	3A	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14A	21	21	21	14
SOUTH AFRICA	14	7	7	7	7	7B	14	21	21	21	21	14
U.S.S.R.	7	7	3A	3A	7	7	7B	14	7B	7B	7B	7

WESTERN UNITED STATES TO:

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ARGENTINA	14	14	7	7	7	7	7	14	14A	21	21	21
AUSTRALIA	21	14A	14	7B	7	7	7	7	7A	14	14	14
CANAL ZONE	14	7A	7	7	7	7	7	14	21	21	21	21
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HAWAII	21	14A	14	7	7	7	7	3	7A	21	21A	21
INDIA	7	14	7B	7B	7B	7	7	7	7	7	7B	7B
JAPAN	21	14	7B	7	3A	3A	3	3	7	7	7B	14
MEXICO	14	7	7	7	7	7	7	7A	21	21	21	14
PHILIPPINES	21	14	7B	7B	7B	7	7	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	7	14A	21	21	21
SOUTH AFRICA	14	7	7	7	7	7B	7B	7B	14	21	21	14
U.S.S.R.	7B	7	3A	3	3A	7	7	7	7A	7B	7B	7B
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